

Fountain Paint Pot Area Trail Guide

*Including
Great Fountain
and
Firehole Lake
Drive*



**Yellowstone
National Park**

50¢ donation

DANGER STAY ON WALKWAYS

Hot Water • Thin Crust

Protect Yellowstone's Treasures

Hydrothermal features are fragile rarities of nature. Yellowstone preserves the largest collection of hydrothermal features on the planet. You have an unparalleled opportunity to view hot springs, geysers, mudpots, and fumaroles in a natural setting.

Change takes place naturally in a hydrothermal area, but people can disrupt these processes and cause irreparable damage.

Rocks, sticks, and other objects thrown into a hydrothermal feature may be permanently cemented in place, choking off water circulation and ending all activity.

For the sake of all who follow, never throw objects into any feature. Stay on established walkways for your safety and to protect fragile formations that have formed over thousands of years.

It is illegal to collect any natural or cultural objects or to remove, deface, or destroy any plant, animal, or mineral in Yellowstone National Park. Do not smoke in or bring pets into Yellowstone's hydrothermal areas. Bring drinking water; take out all trash.

While viewing or photographing the area, protect your camera, glasses, and binocular lenses from hydrothermal heat and spray.

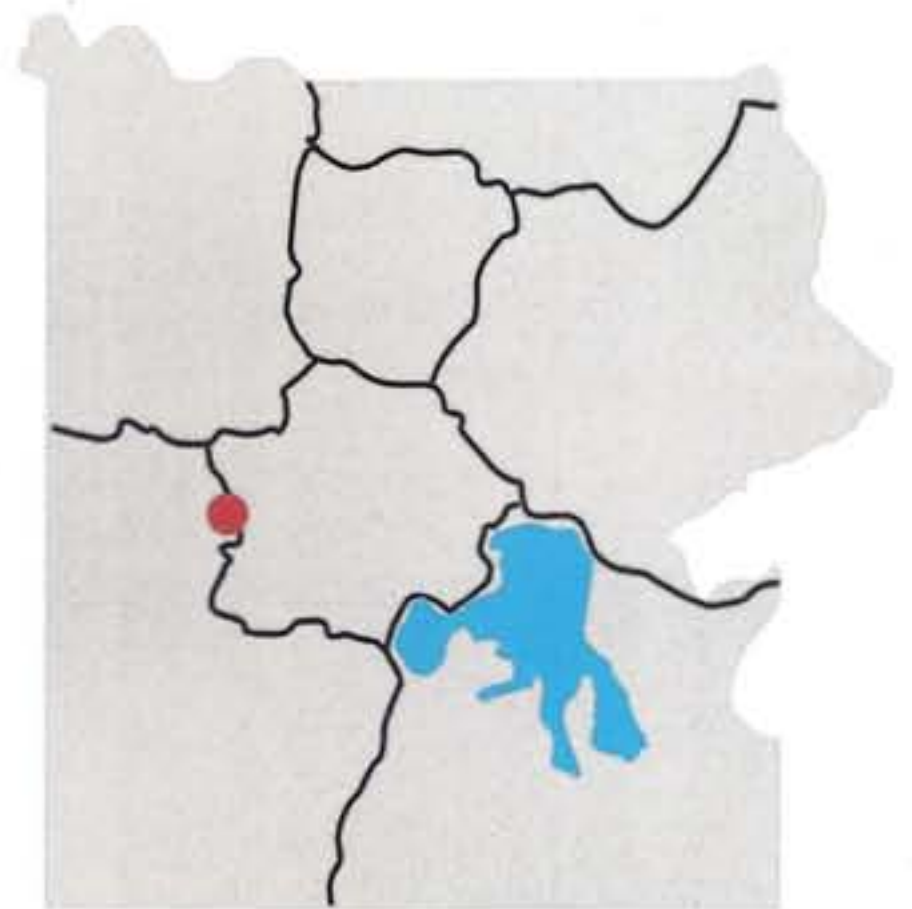
Toxic Gases exist in Yellowstone. Dangerous levels of hydrogen sulfide and carbon dioxide have been measured in some hydrothermal areas.

If you feel sick, leave the location immediately.

Help preserve Yellowstone for the future.

Fountain Paint Pot Area

- All of this area is within the Lower Geyser Basin.
- Here you can view the four types of hydrothermal features: geysers, hot springs, mudpots, and fumaroles.
- *Thermus aquaticus*, the thermophile organism that revolutionized DNA processes, was discovered in this area.
- Great Fountain Geyser, on Firehole Lake Drive, is the only geyser outside of the Old Faithful area that interpretive rangers predict (summer only).



Fountain Paint Pot Trail

This trail is an easy 0.5 mile (0.8 km) loop boardwalk. You will see various hydrothermal features that are expressions of Yellowstone's volcanism. No two features are exactly alike, yet they can be grouped into those with a lot of water (hot springs and geysers) and those with limited water (mudpots and fumaroles).

Thermophiles (heat-loving microorganisms such as bacteria) usually form the ribbons of color like you see here. The green, brown, and orange colors are mostly cyanobacteria, which can live in waters as hot as 167°F (75°C). At this temperature they are usually yellow-green. As water cools, different varieties of cyanobacteria appear in shades of orange, rust, or brown. Color may also change with the seasons and sunlight levels.

Thermophile mats in Silex Spring



At **Silex Spring**, consider how this hot water arrived at the surface. Deep beneath your feet, heat from partially molten rock beneath the surface is transmitted up through the earth's crust. Ground water circulating through these rocks becomes heated and follows cracks upward. Where the hot water can escape at the surface, a hot spring forms.

Silex is Latin for silica, the major component of rhyolite, the primary volcanic rock in Yellowstone. Hot water dissolves silica, which precipitates as siliceous sinter along the bottom of the spring and in runoff channels.

Thermophiles thrive in the overflow of Silex Spring. They provide food for flies living in and on the hot water. The flies then become food for mites, spiders, insects, and birds.

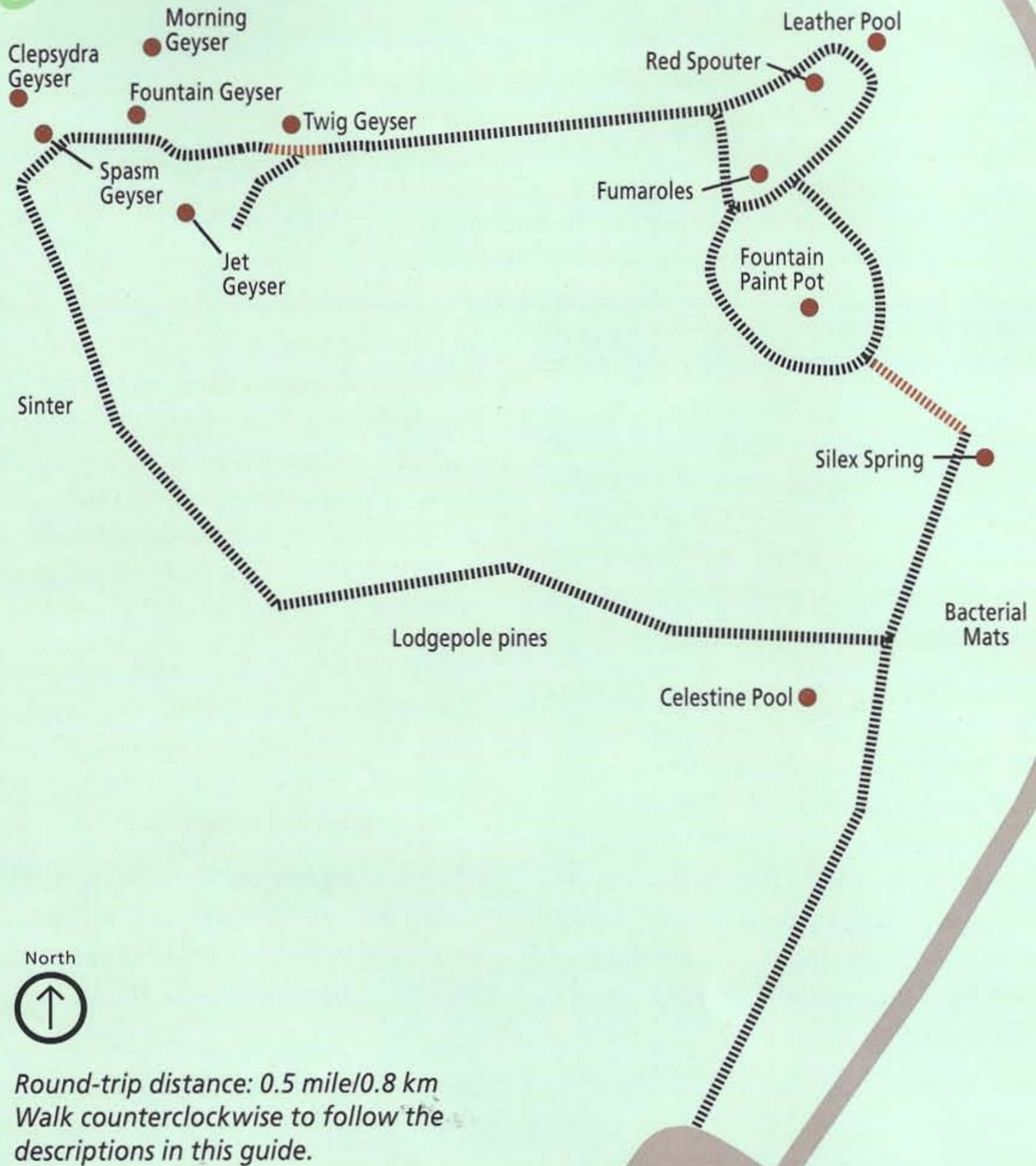
Mats and flies don't exist in the pool or at the start of the overflow where the water is too hot (167–199°F; 75–93°C) for most thermophiles.

The activity of Silex Spring, like that of other hydrothermal features, can change. For example, after 21 years of dormancy, Silex Spring erupted many times from 2000 to 2006.

Do not touch the water or thermophile mats. The water can scald you, and your touch can disturb thermophiles.

Fountain Paint Pot Trail

GEYSER AREA



Legend

-  Boardwalk, may require assistance
-  Stairs or steep grade
-  Hydrothermal Feature
-  Parking
-  Restrooms



to Old Faithful area
& entrance to Firehole Lake Drive

Firehole Lake Drive
(one-way drive)

At **Fountain Paint Pot**, what you see varies with the season. In early summer the **mudpots** are thin and watery from abundant rain and snow. By late summer they are quite thick. If the mud is thick today, watch out! Bursting bubbles may lob mud over the rail.

The mud is composed of clay minerals and fine particles of silica. In this area the rock is rhyolite, which is composed primarily of quartz and feldspar. Acids in the steam and water break down the feldspar into a clay mineral called kaolinite. The Crow tribe used to paint their tipis with this mud.

The hiss and roar of a **fumarole** comes from gases—steam, carbon dioxide, and a little hydrogen sulfide—rushing from the earth through a vent. A fumarole's channel system reaches down into the hot rock masses, but it contains very little water. When water contacts the hot rock, it flashes into steam, which increases its volume 1500 times and drives the gases from the vent.

Leather Pool underwent dramatic changes after the Hebgen Lake Earthquake of 1959.

Prior to the earthquake, it was a warm (143°F/62°C) pool that supported leather-like thermophilic brown bacteria. After the earthquake, water temperatures rose to boiling and killed the microorganisms. Since that time, Leather Pool has cooled and again supports the brown bacteria.

Red Spouter, which originated with the Hebgen Lake Earthquake, exhibits the behavior of all four thermal features. In the spring and early summer it is a muddy hot spring that may seem like a geyser as it splashes reddish water several feet high. As the water table lowers in late summer and fall, Red Spouter seems more like a big mudpot, and then a hissing fumarole.

Distant hills and mountains comprise a **volcanic tableland**, described later.

Before you descend the stairs, walk out to the viewpoint on your left to view the **geysers** below. From this overlook you might see half a dozen geysers erupting at the same time.

Yellowstone is one of the few places in the world where geysers occur. The essentials for geysers and hot springs exist here. Snow and rain provide water, heat from deep in the earth warms the rock and water above it, and fractures in the rock provide the “plumbing” through which the water circulates.

A geyser's channels have constrictions that prevent the water from circulating freely to the surface where the heat would escape. Pressure builds. Steam rises and is trapped by the constrictions and overlying cooler water. At a critical point the confined steam actually lifts the cooler water and causes the geyser to overflow or splash. Pressure release continues, more steam rises and forces water out of the vent. The eruption begins.

Clepsydra Geyser



Twig Geyser is the first regularly erupting geyser on this trail. Look for it at the base of the steps on the right. Twig erupts in a series of brief eruptions 2–10 feet (0.6–3 m) high.

On your left, **Jet Geyser** may erupt before an eruption from Fountain Geyser. During its active period, Jet erupts every few minutes up to 20 feet (6 m).

Across from Jet, **Fountain Geyser** may appear empty before an eruption. When it does erupt, it is one of the most impressive geysers in the park. Eruptions reach 20–50 feet (6–15 m) and last 25 minutes or more.

Behind Fountain, you can see the pool for **Morning Geyser**, which seldom erupts. Should you be so lucky, you will see one of the park's largest geysers. Morning's eruptions have been high (80–200 feet/25–61 m) and wide (100 feet/31 m).

Before 2006, **Spasm Geyser** erupted for an hour or more until Fountain erupted; but now its eruptions are shorter and more frequent. Spasm's eruptions may start with bursts up to 20 feet (6 m), then splashes about 3 feet (0.9 m) high.

You will probably see **Clepsydra Geyser** erupting. This nearly constant performer splashes from several vents and its steam can be seen throughout the Lower Geyser Basin. Its name is Greek for “water clock,” and was given because the geyser used to erupt every three minutes. Since the 1959 Hebgen Lake Earthquake, Clepsydra erupts almost without pause. Sometimes it stops near the end of or after Fountain's eruption.

Below Clepsydra you can see the vast amount of sinter deposited in this area. Sinter was first deposited by hydrothermal activity in the Firehole Valley as glacial ice retreated. It

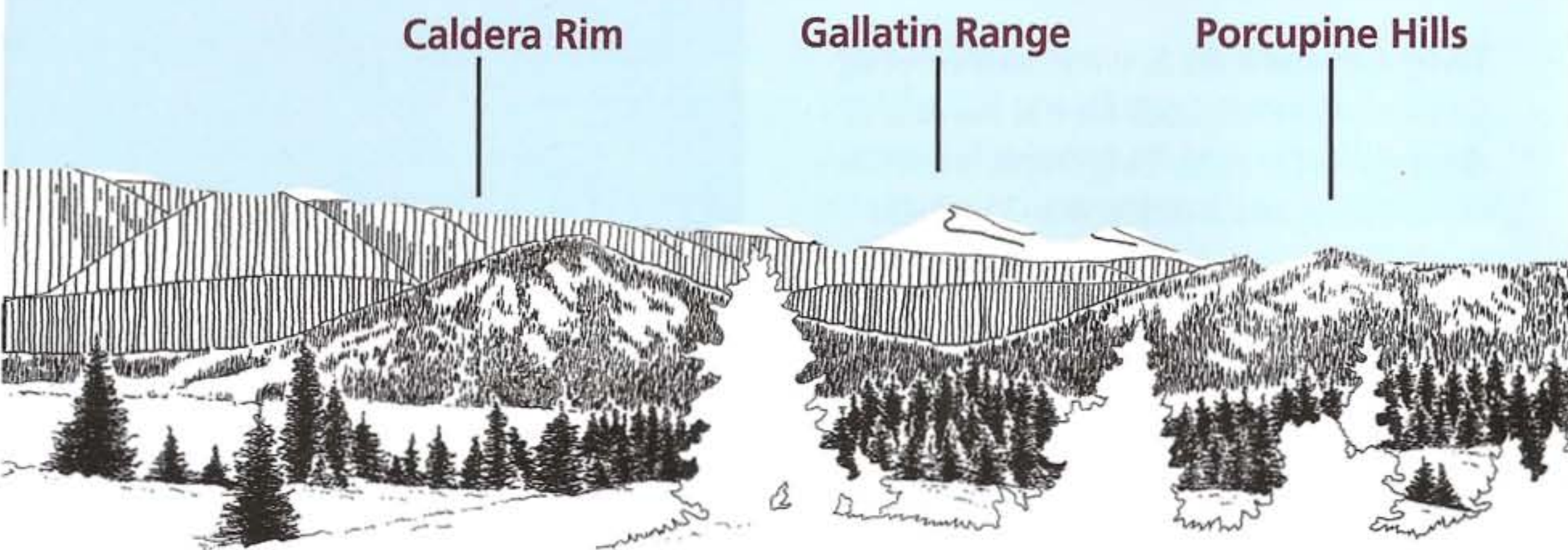


Fountain Geyser

continues to accumulate at different rates depending on the water chemistry of each spring and the rate at which it erodes. The sinter mound beneath these geysers has been building for thousands of years.

Dead **lodgepole pine trees** in the geyser basin are pioneers that did not survive. Establishing a toehold in thin new soil, the trees enriched the soil through natural recycling of minerals and organic material. In time the increasing humus would have nurtured a mature forest—if the trees hadn't drowned when nearby hot springs shifted. Silica also penetrated the trees and hardened their bases. Perhaps lodgepoles will one day grow again in this area. Notice the grasses and other plants starting the cycle.

Celestine Spring is the last hot spring on this trail. No documentation exists of how this spring was named—but its blue color does seem to match the deep blue of the sky.



The Volcanic Tableland

The view to the north is a panorama of the major events of Yellowstone's geologic past; these events created this area's unusual features. Today's landscape had its beginning when the earth's crust was bent, fractured, and heaved into high mountains such as the Gallatin Range in the distance.

Next, volcanic eruptions shaped the land. A massive eruption 640,000 years ago created the Yellowstone Caldera; its rim is in the foreground of the Gallatins and to your left. You can see younger lava flows on the skyline of the Madison Plateau to the west.

At various times in its history, Yellowstone has been buried beneath glaciers. During the most recent glaciation era, which ended 13,000–14,000 years ago, an ice cap covered the center of the park. Glaciers extended over the plateau into the valleys of the Firehole and Madison rivers. As the gravel-laden glaciers covered hot springs and other hydrothermal features, the ice melted so rapidly that great mounds of gravel were deposited. The Porcupine Hills (the low hills in the foreground with sparse trees) are just such gravel mounds. On cold mornings you can still see steam rising from the hot springs in these hills.

Surprise Pool on Firehole Lake Drive

Earthquake Effects

The Lower Geyser Basin, of which Fountain Paint Pot is a part, sits on unstable glacial gravel, which rests upon solid rock. The jarring energy of an earthquake can make the gravel vibrate and shift position, and compact or fracture. All these changes affect water supplies to hot springs. They might force muddy water to the surface, clouding existing pools or creating new ones. They might divert water from a pool, causing it to dry up. Water temperatures might also increase or decrease due to these subsurface changes. In the days after the Hebgen Lake Earthquake of 1959, all the above changes were observed in various springs of the Firehole geyser basins. The epicenter (point of the quake's origin) was determined to be about 31 air miles (50 km) to the northwest.



Firehole Lake Drive



Firehole Lake Drive

From Fountain Paint Pot, drive 1.2 mile (2 km) south (toward Old Faithful) to Firehole Lake Drive, a 2-mile (3 km) drive that passes geysers, hot lakes, hot springs—even a hot cascade.

To see **Firehole Spring**, stop at the first long pullout on your left. Early explorers thought the large bubbles looked like flashes of light—hence the origin of the spring's name.

At the next parking area, view **Surprise Pool**. Early visitors threw sand in the pool to cause “surprise” boiling. Luckily their behavior caused no permanent damage, and you can still enjoy the deep blue color and wide intricate overhangs of sinter.

Whether **Great Fountain Geyser** is in eruption or not, you will see why the early explorers were so enthusiastic about this geyser's beauty. *(See photo and caption.)* Eruptions average 100 feet (31 m) high, but some visitors are rewarded with rare “superbursts” of 200 feet (61 m) or more. Eruptions last 45–60 minutes in a series of bursts. Great Fountain takes 10–14 hours to rebuild to an eruption. The pool slowly fills, then begins to overflow 70–100 minutes before the eruption.

Like most geysers, Great Fountain experiences periods of irregularity. But, for the most part, it is dependable. While waiting for its display, watch for eruptions of White Dome Geyser to the northwest along the one-way road.

The massive cone of **White Dome Geyser** indicates it has probably been erupting for hundreds of years. From such an enormous cone one might expect enormous eruptions. However, its narrow vent has been nearly sealed off with sinter deposits. Eruptions reach a height of approximately 30 feet (9 m)—the

One of Firehole Lake's geysers



“Soon this geyser was in full play. The setting sun shining into the spray and steam drifting towards the mountains gave it the appearance of burnished gold, a wonderful sight. We could not contain our enthusiasm; with one accord we all took off our hats and yelled with all our might.”—Cook-Folsom-Peterson Expedition of 1869, viewing Great Fountain

height of the entire cone. The eruption lasts about two minutes before gradually changing into spray and steam. Intervals between eruptions are usually 30–35 minutes, but may be as long as 3 hours.

In the 1930s, a road was built right across the mound of **Pink Cone Geyser**. Fortunately this seems to have had little effect on the geyser's performance.

No record of Pink Cone erupting exists until 1887. From 1889 to 1936, it seemed to be dormant; then for the next 23 years, it erupted approximately every two days. After the Hebgen Lake Earthquake in 1959, its intervals were as short as 50 minutes with eruptions of similar duration. Through the years, the time between eruptions has increased to approximately 20 hours; the duration is about 100 minutes; and it erupts up to 30 feet (9 m).

Small amounts of manganese oxide cause Pink Cone's color. This mineral also comprises many of the brown, gray, or black deposits.

The largest hot spring in this area, **Firehole Lake**, lies to your right as you enter the large parking area. Several vents supply water that averages 158°F (70°C). The water contains high levels of carbon dioxide. This allows the water to transport more calcium, which forms deposits of travertine around the lake's edge and in pearly deposits around its geysers. The unusual black deposits are manganese oxide; dark mats of thermophiles also grow here.

Along the shore of this hot lake, **Young Hopeful** splashes almost continuously up to 2 ft (0.6 m). Other small geysers beyond this feature splash water up to 10 ft (3 m).

The waters across the parking lot have other surprises. Walking counterclockwise, you'll see

Steady Geyser. Its mineral deposits contain calcium carbonate (appearing as travertine), silica (appearing as siliceous sinter), and manganese oxide, which causes a gray color. Manganese oxide also accounts for the dark color of **Black Warrior Lake**. As the boardwalk reaches the end of this pool, you'll cross **Hot Cascades**, a steaming fall of water from Black Warrior into **Hot Lake**.

Don't miss Midway Geyser Basin, two miles (3 km) south of the entrance to Firehole Lake Drive. It features Excelsior Geyser Crater and Grand Prismatic Spring, the park's largest hot spring. The Midway Geyser Basin boardwalk meets federal guidelines for accessibility.

For More Information

www.nps.gov/yell

If you would like to learn more about geology and hydrothermal features, these and other items are sold by the Yellowstone Association in visitor centers:

The Geysers of Yellowstone, T. Scott Bryan

Life at High Temperatures, Dr. Thomas Brock

Interpreting the Landscape of Grand Teton and Yellowstone National Parks,
John N. Good and Kenneth L. Pierce

Seen & Unseen: Discovering the Microbes of Yellowstone, Kathy Sheehan et al.

Windows into the Earth: The Geologic Story of Yellowstone and Grand Teton National Parks,
Robert B. Smith and Lee J. Siegel

DVDs: *Yellowstone: A Symphony of Fire and Water*
The Complete Yellowstone

Photos: Cover (Fountain Paint Pot), NPS/Peaco; all others courtesy of C. Duckworth



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