

Old Faithful Area Trail Guide

*Including
Upper Geyser,
Black Sand
and Biscuit
Basins*



**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.

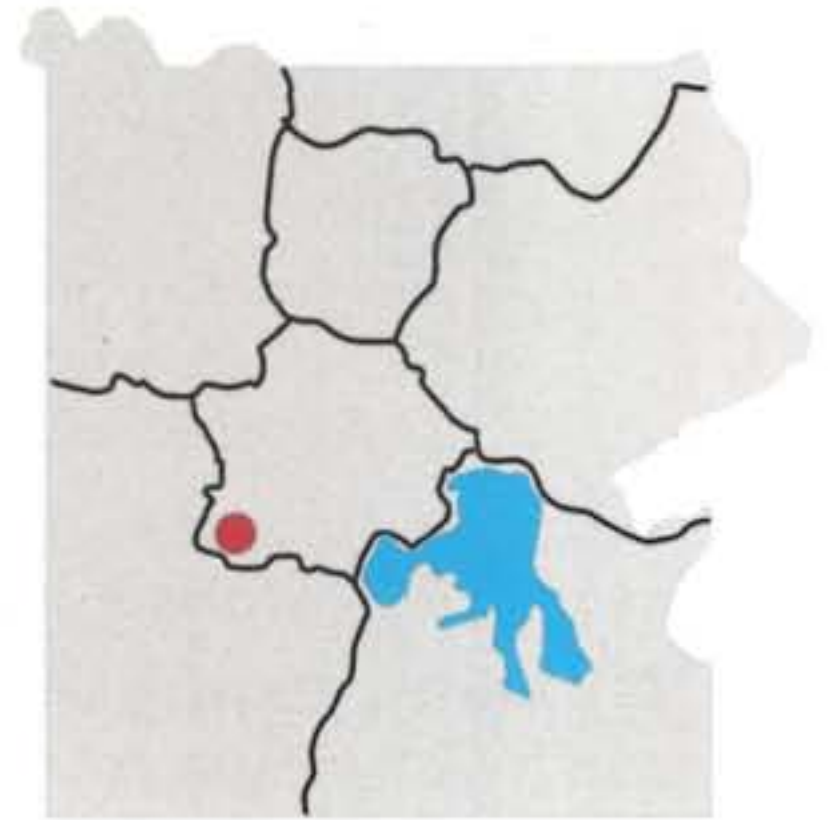
Toxic Gases exist in Yellowstone. Dangerous levels of hydrogen sulfide and carbon dioxide have been measured in some hydrothermal areas.

If you feel sick, leave the location immediately.

Help preserve Yellowstone for the future.

Old Faithful Area

- Old Faithful is in the Upper Geyser Basin, one of three large geyser basins along the Firehole River.
- The majority of the world's active geysers are here.
- Only four other locations in the world—Russia (Kamchatka), Chile, New Zealand, and Iceland—have large concentrations of hydrothermal features.
- Five geysers here—Old Faithful, Castle, Grand, Daisy, and Riverside—are predicted by the rangers.



This area's concentration of hydrothermal features provides ample evidence of Yellowstone's volcanic geology. Within the past two million years, 3 major eruptions have occurred in Yellowstone—and the volcano is still active. Molten rock, or magma, may be as close as 3–8 miles (5–13 km) underground. This magma provides the first ingredient for thermal features: heat. Rain and snow supply the second: water. The water seeps down several thousand feet (more than a kilometer) below the surface where it is heated. Underground cracks form the third ingredient: a natural “plumbing” system. Hot water rises through the plumbing to produce hot springs and geysers.

In a **geyser**, constrictions in the plumbing prevent water from circulating freely to the surface where heat would escape. The deepest water can exceed the surface boiling point of 199°F (93°C). The surrounding pressure also increases with depth. Increased pressure exerted by the enormous weight of the overlying water prevents the deeper water from boiling. Bubbling upward, steam expands as it nears the top of the water column. At a critical point, the confined bubbles lift the water above and the geyser overflows. This decreases pressure on the system, and violent boiling results. Instantly, a huge volume of steam is produced that forces water out of the vent in a superheated mass. Eruption begins.

In an eruption, water is expelled faster than it can enter the geyser's plumbing system. The heat and pressure gradually decrease. The eruption stops when the water reservoir is exhausted or when the gas bubbles diminish enough to be able to rise without ejecting the water. **Fountain-type geysers** shoot water out in various directions from a pool. **Cone-type geysers** erupt in a concentrated jet of water, usually from a cone formation.

Other Hydrothermal Features

Hot springs are closely related to geysers, but their underground channel systems are not constricted. Water circulates to the surface where heat escapes through evaporation or runoff. The cooler water returns to the underground system, keeping it in equilibrium.

Fumaroles, Yellowstone's hottest surface features, vent steam. Their underground systems reach down into the hot rock masses, but contain very little water. When rain or melting snow drain into the fumarole's plumbing, it converts instantly to steam.

Mudpots are acidic features with a limited water supply. Hydrogen sulfide, which rises from deep within the earth, is used by some microorganisms as an energy source. They help convert the smelly gas to sulfuric acid, which breaks down rock into clay. Various gases escape through the wet clay mud and cause it to bubble and plop.

Upper Geyser Basin



Legend

- Paved trail—bicycles OK; wheelchair-users may require assistance
- Boardwalk—no bicycles; wheelchair-users may require assistance
- Improved trail—no bicycles; wheelchair-users may require assistance
- Backcountry trail—no bicycles
- Stairs or steep grade
- Road
- Bicycle trail
- Hydrothermal feature
- Food
- Service Station
- Lodging
- Medical Clinic
- Parking
- Picnic Area
- Post Office
- Ranger Station
- Restrooms
- Store
- Information
- Meets federal standards for wheelchair-accessibility

Form and Function

As you explore the Upper Geyser Basin, notice the variety of mineral formations surrounding its geysers and hot springs. When hot water erupts from a geyser or flows from a hot spring, it cools and leaves behind a thin mineral deposit called siliceous sinter, which is primarily composed of silicon dioxide (the same material found in glass). When this mineral is splashed from geysers, it is known as geyserite.

Mineral formations offer clues to the behavior of a feature and to its age. If you see thin shelves of lacy sinter overhanging a pool, you're probably looking at a hot spring instead of an active geyser. If you know the average rate that sinter forms in a thermal area, you can also guess the age of a formation. In the Old Faithful area, sinter formation averages about one inch (2.5 cm) per century. Imagine, then, the age of Giant Geyser, which has one of the tallest geyser cones in the world.

Primal Colors

Throughout Yellowstone, the ribbons of color in and around the thermal features are usually formed by thermophiles (heat-loving organisms). These organisms—algae, bacteria, and archaea—are primitive life forms that have inhabited the earth for almost four billion years. Cyanobacteria, which are common in the Old Faithful area, thrive in temperatures up to 167°F (75°C). Other thermophiles exist in even hotter water.

Research on some of these life forms has sparked revolutions in an array of scientific fields. In 1966, Dr. Thomas Brock discovered a bacterium, *Thermus aquaticus*, in a Yellowstone hot spring. Scientists extracted an enzyme from this bacterium, which has contributed to developing DNA "finger-printing," a powerful tool widely used in criminal and medical research. Numerous other thermophiles have been found in Yellowstone, each producing unique enzymes potentially important to society.

More Than Old Faithful



Top: Riverside Geyser erupting over the Firehole River

Bottom: Elk and other large animals such as bison winter in the hydrothermal basins; warm ground melts snow, making it easier to find food

The largest concentration of geysers in the world is in the Upper Geyser Basin. This guide discusses several of the more prominent geysers and their eruption patterns. During summer, you can find eruption predictions for six major geysers posted in the lobby of the Old Faithful Visitor Center. (Five are here; the sixth—Great Fountain—is in the Lower Geyser Basin north of here.) However, a geyser's pattern of eruptions may change at any time. The predicted eruption times are the best estimates available.

Observation through the years has revealed that several geysers, such as Riverside, have pre-eruption characteristics that provide a basis for accurate prediction of eruption times. However, the characteristics may change from time to time. Most geysers have so little evidence of a behavior pattern that their eruptions are not predictable.

Old Faithful erupts more frequently than any of the other big geysers, although it is not the largest or most regular geyser in the park. Its average interval between eruptions is about 93 minutes, varying from 50–127 minutes. An eruption lasts 1½ to 5 minutes, expels 3,700–8,400 gallons (14,000–32,000 liters) of boiling water, and reaches a height of 106–184 feet (30–55 m). Members of the Washburn Expedition of 1870 named this geyser for its consistent performance. Although its average interval has lengthened, Old Faithful is as spectacular as it was a century ago.

Geyser Hill

If **Anemone Geyser** is empty when you arrive, wait a few minutes to watch the stages of a typical eruption. The pool fills, overflows, and bubbles rise. Suddenly, Anemone erupts 6 feet (2 m) or more. The water then drains with



Grotto Geyser

experience a tremendous steam phase, and continue activity for twelve hours to two days or more.

Castle Geyser to Morning Glory Pool

a gurgling sound. The cycle is repeated usually every 7–10 minutes.

Plume Geyser could catch you by surprise. It erupts every hour or so in 3–5 bursts that can reach heights of 25 feet (8 m).

Beehive Geyser is a favorite performer in this geyser basin, but is irregular. When active, it typically erupts once or twice daily and lasts 4–5 minutes. The narrow cone acts like a nozzle, projecting a powerful water column to a height of 150–200 feet (46–61 m).

The **Lion Group** consists of four geysers, from left to right: Little Cub, Lioness, Big Cub, and Lion. Lion has the largest cone and erupts up to 70 feet (21 m) for 1–7 minutes. If you witness its eruption, you might hear how this geyser got its name: the eruption is often preceded by sudden gushes of steam and a deep roaring sound.

Photographers love **Doublet Pool** for its series of ledges, elaborate border ornamentation, and deep blue waters. Periodically, Doublet produces vibrations, surface wave motion, and audible thumps—most likely caused by collapsing gas and steam bubbles.

Giantess Geyser, a fountain-type geyser, earns its mighty name during its infrequent eruptions. Multiple water bursts can reach 200 ft (60 m) and the ground can shake from underground steam explosions. During an eruption sequence, which can occur 2–6 times a year, Giantess may erupt twice hourly,

The magnificent cone of **Castle Geyser** is thousands of years old and rests upon even older platforms. Together, they form one of the largest sinter formations in the world. Castle is currently erupting about every 14 hours. A water eruption frequently reaches 75 feet (24 m) and lasts about 20 minutes, followed by a noisy steam phase of 30–40 minutes. If Castle has a minor eruption—a few minutes of water but no steam—its next major eruption cannot be predicted.

With temperatures above 199°F (93°C), **Crested Pool** is almost constantly boiling, sometimes to 6 feet or more (2 m). The extreme heat prevents most bacterial growth, resulting in exceptionally clear blue water. Boiling is particularly active along the intricate sinter formation circling the spring, the “crested” edge. Listen for the sizzling.

If you see a crowd at **Grand Geyser** and the pool looks full, wait awhile. You might get lucky and see the tallest predictable geyser in the world erupt. A classic fountain geyser, Grand erupts with powerful bursts rather than a steady column like Old Faithful. An average eruption lasts 9–12 minutes and consists of 1–4 bursts, sometimes reaching 200 ft (60 m).

Beauty Pool shows its brightest colors when its water is hottest. When the water is cooler, as it has been recently, earth-toned thermophiles thrive. Beauty is closely related to neighboring **Chromatic Pool**. During periodic energy shifts, the level of one spring rises as the other descends.

Morning Glory Pool

Giant Geyser became dormant in 1955. Since then, it has slowly become active—and erratic. During 2007, it erupted more than 50 times; during 2010, only once. Its spectacular eruptions last more than an hour and can reach 250 feet (76 m). Before and during eruptions, small geysers on the same platform may erupt.

A popular performer, **Grotto Geyser** splashes 15 feet (5 m) for 1½ to more than 15 hours. The weirdly shaped cone may have resulted from sinter covering trees.

Situated on the bank of the Firehole River, **Riverside Geyser** is one of the most picturesque and predictable geysers in the park. During its 20-minute eruptions, a 75-foot (23 m) column of water arches gracefully over the river. Eruptions are about six hours apart. Watch for water flowing over the edge of the cone beginning 90–120 minutes before an eruption. Look for rainbows in its spray.

Long a favored destination for park visitors, **Morning Glory Pool** was named in the 1880s for its remarkable likeness to its namesake flower. This blue pool soon became victim to vandalism; over the years people have thrown tons of coins, trash, rocks, and logs into the pool. Much of this debris became embedded in the sides and vent of the spring, which reduced the water circulation and thus the water temperature. Vandalism has decreased, but remains a problem. Natural changes may be cooling the water too. Cooler temperatures allow orange- and yellow-colored bacteria to thrive. Please report vandalism to a ranger.

Walk up the hill to **Daisy Geyser**, where you will find a good view of the geyser basin—and maybe a close view of this geyser's eruption. Daisy erupts at an angle to a height of 75 feet (23 m) for 3–5 minutes. Daisy is usually



predictable, with eruption intervals of 120–210 minutes. The exception is when the nearby and unpredictable Splendid Geyser erupts.

Black Sand & Biscuit Basins

You can walk to **Black Sand Basin** from Daisy Geyser or drive one mile (1.6 km) northwest of Old Faithful along the main road. Named for sand derived from black volcanic glass (obsidian), this basin features some of the most splendid hot springs in Yellowstone. You will find **Emerald Pool**, **Rainbow Pool**, and **Sunset Lake** here. Sunset Lake is actually a geyser, but its eruptions are infrequent and seldom noticed because of the heavy steam over the water. Watch for **Cliff Geyser** on the edge of Iron Spring Creek. It erupts every few minutes, sometimes to 40 feet (12 m).

Three miles (5 km) north of Old Faithful is **Biscuit Basin**, named for the unusual biscuit-like deposits that used to surround **Sapphire Pool**. Following the 1959 Hebgen Lake Earthquake, Sapphire erupted, and the “biscuits” were blown away; it last erupted in 1991. Sapphire remains one of the most beautiful blue pools in the park. **Mustard Spring** provides a bright color contrast, and **Jewel Geyser** adds excitement as it erupts every 7–10 minutes.

Castle Geyser

Geyser Predictions

Old Faithful _____

Castle _____

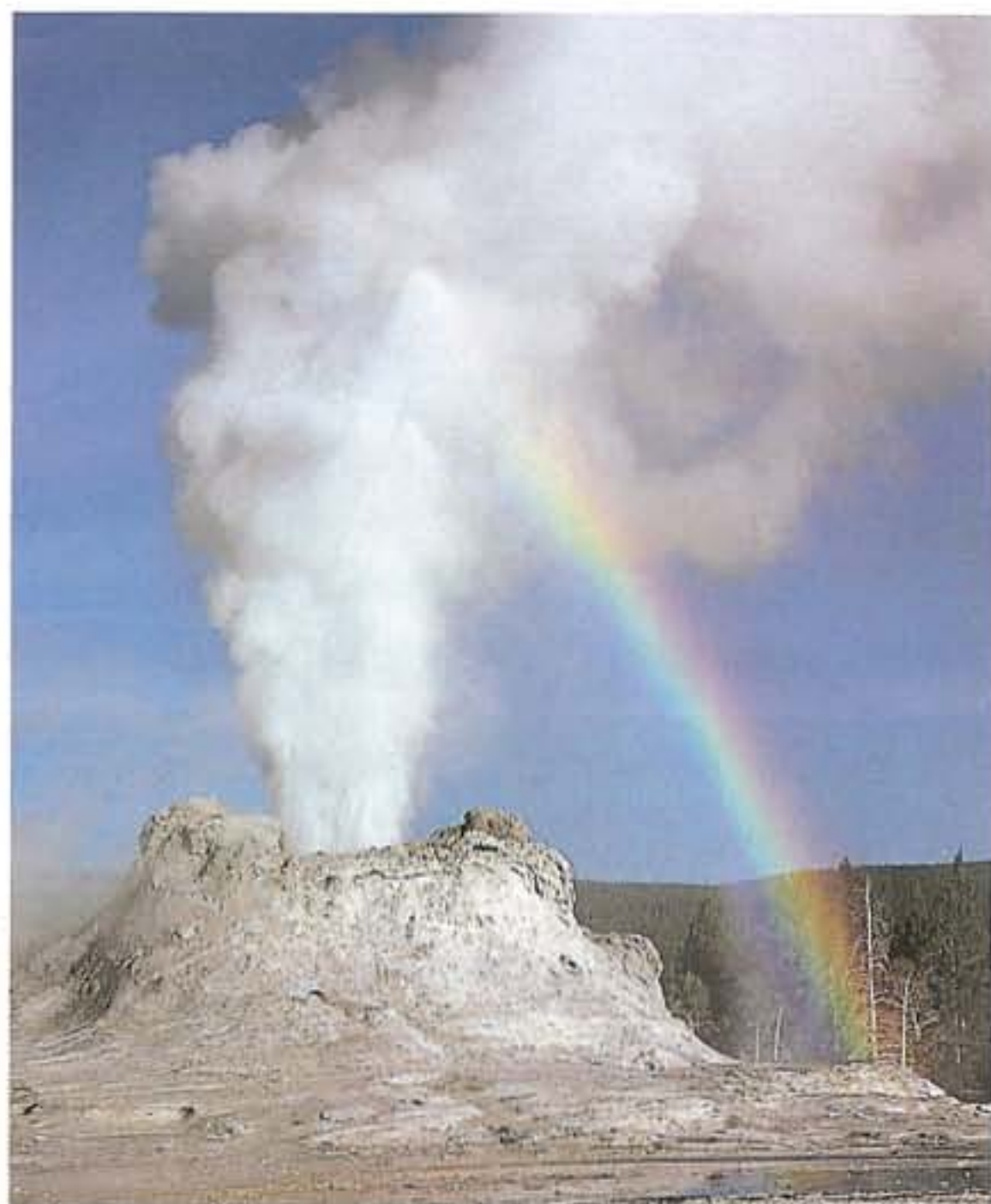
Grand _____

Daisy _____

Riverside _____

Great Fountain _____

(summer only; located 8 mi/12.6 km north of Old Faithful on Firehole Lake Drive)



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 (Old Faithful) and all others by NPS photographers.



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