Geothermal Features and How They Work

With half of the earth's geothermal features, Yellowstone holds the planet's most diverse and intact collection of geysers, hot springs, mudpots, and fumaroles. Its more than 300 geysers make up two thirds of all those found on earth. Combine this with more than 10,000 thermal features comprised of brilliantly colored hot springs, bubbling mudpots, and steaming fumaroles, and you have a place like no other. Geyserland, fairyland, wonderland—through the years, all have been used to describe the natural wonder and magic of this unique park that contains more geothermal features than any other place on earth.

Yellowstone's vast collection of thermal features provides a constant reminder of the park's recent volcanic past. Indeed, the caldera provides the setting that allows such features as Old Faithful to exist and to exist in such great concentrations.

Hot Springs and How They Work

In the high mountains surrounding the Yellowstone Plateau, water falls as snow or rain and slowly percolates through layers of porous rock, finding its way through cracks and fissures in the earth's crust created by the ring fracturing and collapse of the caldera. Sinking to a depth of nearly 10,000 feet, this cold water comes into contact with the hot rocks associated with the shallow magma chamber beneath the surface. As the water is heated, its temperatures rise well above the boiling point to become superheated. This superheated water, however, remains in a liquid state due to the great pressure and weight pushing down on it from overlying rock and water. The result is something akin to a giant pressure cooker, with water temperatures in excess of 400°F.

The highly energized water is less dense than the colder, heavier water sinking around it. This creates convection currents that allow the lighter, more buoyant, superheated water to begin its slow, arduous journey back toward the surface through rhyolitic lava flows, following the cracks, fissures, and weak areas of the earth's crust. Rhyolite is essential to geysers because it contains an abundance of silica, the mineral from which glass is made. As the hot water travels through this "natural plumbing system," the high temperatures dissolve some of the silica in the rhyolite, yielding a solution of silica within the water.

At the surface, these silica-laden waters form a rock called geyserite, or sinter, creating the massive geyser cones; the scalloped edges of hot springs; and the expansive, light- colored, barren landscape characteristic of geyser basins. While in solution underground, some of this silica deposits as geyserite on the walls of the plumbing system forming a pressure-tight seal, locking in the hot water and creating a system that can withstand the great pressure needed to produce a geyser.

With the rise of superheated water through this complex plumbing system, the immense pressure exerted over the water drops as it nears the surface. The heat energy, if released in a slow steady manner, gives rise to a hot spring, the most abundant and colorful thermal feature in the park. Hot springs with names like Morning Glory, Grand Prismatic, Abyss, Emerald, and Sapphire, glisten like jewels in a host of colors across the park's harsh volcanic plain.

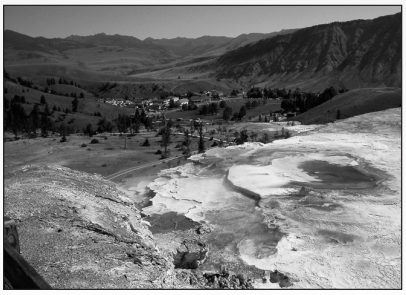
Mudpots & How They Work

Where hot water is limited and hydrogen sulfide gas is present (emitting the "rotten egg" smell common to thermal areas), sulfuric acid is generated. The acid dissolves the surrounding rock into fine particles of silica and clay that mix with what little water there is to form the seething and bubbling mudpots. The sights, sounds, and smells of areas like Artist and Fountain paint pots and Mud Volcano make these curious features some of the most memorable in the park.

Fumeroles (Steam Vents) and How They Work

Fumaroles, or steam vents, are hot springs with a lot of heat, but so little water that it all boils away before reaching the surface. At places like Roaring Mountain, the result is a loud hissing vent of steam and gases.

Mammoth Hot Springs Terraces and How They Work



At Mammoth Hot Springs, a rarer kind of spring is born when the hot water ascends through the ancient limestone deposits of the area instead of the silica-rich lava flows of the hot springs common elsewhere in the park. The results are strikingly different and unique. They invoke a landscape that resembles a cave turned inside out, with its delicate features exposed for all to see. The flowing waters spill across the surface to sculpt magnificent travertine limestone terraces. As one early visitor described them, "No human architect ever designed such intricate fountains as these. The water trickles over the edges from one to another, blending them together with the effect of a frozen waterfall."

How They Work

As ground water seeps slowly downward and laterally, it comes in contact with hot gases charged with carbon dioxide rising from the magma chamber. Some carbon dioxide is readily dissolved in the hot water to form a weak carbonic acid solution. This hot, acidic solution dissolves great quantities of limestone as it works up through the rock layers to the surface hot springs. Once exposed to the open air, some of the carbon dioxide escapes from solution. As this happens, limestone can no longer remain in solution. A solid mineral reforms and is deposited as the travertine that forms the terraces.

Geysers and How They Work

Sprinkled amid the hot springs are the rarest fountains of all, the geysers. What makes them rare and distinguishes them from hot springs is that somewhere, usually near the surface in the plumbing system of a geyser, there are one or more constrictions. Expanding steam bubbles generated from the rising hot water build up behind these constrictions, ultimately squeezing through the narrow passageways and forcing the water above to overflow from the geyser. The release of water at the surface prompts a sudden decline in pressure of the hotter waters at great depth, triggering a violent chain reaction of tremendous steam explosions in which the volume of rising, now boiling, water expands 1,500 times or more. This expanding body of boiling superheated water bursts into the sky as one of Yellowstone's many famous geysers.

There are more geysers here than anywhere else on earth. Old Faithful, certainly the most famous geyser, is joined by numerous others big and small, named and unnamed. Though born of the same water and rock, what is enchanting is how differently they play in the sky. Riverside Geyser shoots at an angle across the Firehole River, often forming a rainbow in its mist. Castle erupts from a cone shaped like the ruins of some medieval fortress. Grand explodes in a series of powerful bursts, towering above the surrounding trees. Echinus spouts up and out to all sides like a fireworks display of water. And Steamboat, the largest in the world, pulsates like a massive steam engine in a rare, but remarkably memorable eruption, reaching heights of 300 to 400 feet.

Robert Wilhelm Bunsen. During the 1800s, Bunsen was at the forefront of pioneering geyser research, and many of his theories remain true to this day. Interestingly, the "Bunsen burner" made famous in high school chemistry classes across the world resembles a mini-geyser and also honors the physicist's brilliant career.

Although Bunsen Peak still shows scars from the disastrous 1880s and 1988 Yellowstone fires, the area still captures the interest of outdoor recreationists. Hikers, mountain bikers, and skiers frequently traverse the old Bunsen Peak Road for close-up views.

Gardner River Canyon

Winding its way from the park's north entrance at Gardiner to Mammoth Hot Springs, the Gardner River travels beside area visitors as they navigate their way through the scenic Gardner River Canyon. Layered thick with cottonwood trees, Douglas fir, Rocky Mountain juniper, and willows, the canyon twists its way past old mudslides and rugged sandstone walls. As brilliant as the scenery is, the canyon is most noted for its spectacular wildlife. The canyon is home to a large herd of bighorn sheep, eagles, osprey, and kingfishers, most of which are visible throughout the year. Keep your eyes peeled for the impressive bighorn sheep on the canyon's steep sandstone ledges.