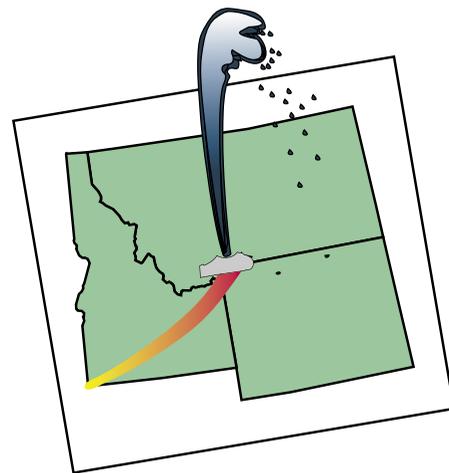


Effects of the Yellowstone Hot Spot



Yellowstone IMAX Theatre

Produced in cooperation with
USDA Forest Service



As part of its mission of being a first class interpretive center, the Yellowstone IMAX Theatre is developing an interpretive display in cooperation with the USDA Forest Service.

The aim of this display is twofold: 1) to show tourists interpretive, scenic, and historical sites in the region surrounding Yellowstone, mainly to the west; and 2) to place these sites in context by showing how geologic events guided human events. The unifying theme of the display that places the sites in context is the Yellowstone Hot Spot.

The Yellowstone Region provides much of the headwaters of the Missouri and Snake River systems. It has a rich history of exploration, migration, and development. Throughout the region there are sites that interpret events that occurred there. Other sites display the scenic beauty of the area, while still others provide recreational enjoyment. Examples of these sites are listed inside.

The Yellowstone Hot Spot today provides the heat that drives the geysers and other thermal activity in Yellowstone National Park. This geologic phenomenon also smoothed a pathway across the Intermountain West, called the Snake River Plain. This provided a corridor for the Oregon Trail.

About 17 million years ago, a plume of hot mantle started rising from deep within the Earth. Because of plate tectonics, the North American plate has moved

over this plume at the rate of about one inch per year. As the plate moves across the hot plume, the crust melts. A hot spot volcano erupts directly above the plume, then goes out of business as the moving plate carries it beyond the plume. The result is a track of dead volcanic fields.

The eruptions of these volcanoes were so violent that they blew incandescent ash over thousands of square miles. When all this rock had been blown out, the ground sank into the resulting underground void forming calderas.

Later eruptions, similar to those now active in Hawaii, covered the ground with black basalt, finishing the smoothing process. The result is the Snake River Plain that extends from southwest Idaho to Yellowstone National Park.

Pioneers were able to use this plain for their migration to Oregon. To the north are the rugged Northern Rocky Mountains that proved extremely difficult to the Lewis and Clark Expedition. To the south are the Basins and Ranges with scorching deserts and numerous steep-sided mountains.

By showing the interaction of the Yellowstone Hot Spot with the human history of the region, the IMAX display will place the interpretive, scenic, and historical sites in their broad contexts. This will guide visitors to these sites and greatly increase their enjoyment and understanding.

GEOLOGY

SNAKE RIVER PLAIN

Crossing Idaho in an arc, the Snake River Plain (50-70 miles wide and 350 miles long) marks the path of the earth's North American plate as it migrated over a heat source unusually close to the surface. All of the easily visible volcanic rocks are basalt flows, which cover greater volumes of rhyolite. The rhyolite erupted as the North American plate passed over the Yellowstone Hot Spot. The basalt came later as the Basin and Range faults began to break the Snake River Plain.

◆ **ST. ANTHONY SAND DUNES:** Extending over an area 35 miles long and up to five miles wide, the dunes consist of quartz sand deposited over millions of years by prevailing winds along the Snake River Plain. Found on top of extinct volcanic vents, many of the dunes surpass those of Death Valley in height.

◆ **HELL'S HALF ACRE LAVA FIELD:** Located on I-15, 30 miles north of Pocatello, Hell's Half Acre was created by a small shield volcano erupting almost 20,000 years ago. The resulting lava flow created a unique transition from rugged, black basalt to the present surrounding wheat fields. Visitors will also be able to distinguish distinct pressure ridges formed by pieces of hard crust once flowing along the cooling lava.

◆ **CRATERS OF THE MOON NATIONAL MONUMENT:** Craters of the Moon contains effects of the most recent volcanic eruptions in the Snake River Plain, namely 4.5 cubic miles of lava covering approximately 643 square miles. This lava field erupted from the north end of the Great Rift and includes some of the best examples of basaltic volcanism in the world. Because of the unusual environment and volcanic rock, N.A.S.A. brought the second set of astronauts here to train before their journey to the moon.

◆ **GREAT RIFT:** A zone of open fissures and volcanic vents that extends almost 60 miles, the Great Rift is the site of origin for more than 60 different lava flows. As the

earth's crustal plates moved in opposite directions, areas within the Snake River Plain weakened and thinned allowing cracks to develop through which magma emerged. Most fissures are filled with basalt and buried under lava flows and cinder cones. Some, however, are gaping holes in the earth's surface.

◆ **HAGERMAN FOSSIL BEDS NATIONAL MONUMENT:** Lava flows dammed the Snake River several times creating Lake Idaho which rivaled present-day Lake Ontario. Plants and animals entombed in lake bottom sediments are today exposed near Hagerman, Idaho. At the celebrated Hagerman Fossil Beds National Monument, fossil horses, rabbits, peccaries, gophers, beaver, and bird remains have been uncovered.

MAJOR EARTHQUAKE SITES

◆ **QUAKE LAKE VISITOR CENTER, GALLATIN NATIONAL FOREST:** In 1959, several faults in the Madison River area moved at the same time causing a landslide which moved at more than 100 mph. In less than a minute, the Hebgen Lake Earthquake (7.5 on the Richter Scale) had moved over 80 million tons of rock damming the Madison River, creating Earthquake Lake. The force of the slide displaced both air and water, creating high velocity winds and a wall of water killing several people. In all, a total of 28 people were killed in this earthquake.

◆ **MOUNT BORAH:** The highest peak in Idaho, at an elevation of 12,662 feet. On October 28, 1983, a 7.3 earthquake shook southeast Idaho, southwest Montana, and western Wyoming, killing 1 person. The resulting fault scarp, at its base, can still be viewed today.

◆ **CENTENNIAL TECTONIC BELT:** Located directly west of Yellowstone National Park, the Centennial Mountains form the border of Idaho and Montana. The Centennials are the only part of the Continental Divide to run east-west for more than 100 miles.

◆ **FAULTED MOUNTAIN BLOCKS:**

- **Tetons:** Having risen within the last ten million years, the eastern face of the Teton Range defines a significant fault scarp and the eastern margin of the Basin and Range Province. A projected line following the Tetons south, lines up with the Wasatch Front.

- **Wasatch:** The eastern edge of the Basin and Range Province lies along the Wasatch Front, defining the face of the Wasatch Range in Utah. A projected line following the Wasatch Front north, passes through the Yellowstone volcano.

- **Hebgen/Red Canyon:** Fault scarps 10-20 feet high can be seen along U.S. Highway 287 on the north shore of Hebgen Lake. This represents the site of the 1959 earthquake.

THERMAL SPRINGS

These springs are situated around the Yellowstone Plateau volcanic field. Surface water sinks two or more miles along deep fractures in fault zones, where it absorbs heat from the hot rocks. The heated water becomes lighter than the cooler water above, and rises to the surface.

◆ **LAVA HOT SPRINGS:** On U.S. Highway 30, along the Portneuf River approximately 35 miles southeast of Pocatello, Idaho.

◆ **HEISE HOT SPRINGS:** Situated along the Snake River off U.S. Highway 26, approximately 25 miles northeast of Idaho Falls, Idaho.

◆ **CHICO HOT SPRINGS:** Approximately 35 miles north of Yellowstone National Park and Gardiner, Montana, just off U.S. Highway 89.

◆ **NORRIS HOT SPRINGS:** Located just off U.S. Highway 287, approximately 80 miles north of West Yellowstone, Montana.

◆ **FAIRMONT HOT SPRINGS:** Situated just off Interstate 90 between Butte and Anaconda, Montana.

◆ **THERMOPOLIS HOT SPRINGS:** Located just off U.S. Highway 20 in Thermopolis, Wyoming.

CALDERAS

◆ **TRACK OF THE YELLOWSTONE HOT SPOT:** The Yellowstone Hot Spot is one of only 40 hot spots throughout the world. This hot spot has been traced as far back as southern Oregon and northern Nevada, 16.1 million years ago. More than 27 calderas and volcanic centers mark the track of the Yel-

lowstone Hot Spot from north of Winnemucca, Nevada, up the Snake River Plain to its present location in Yellowstone National Park.

◆ **YELLOWSTONE:** About 2 million years ago, three eruptive cycles created the Yellowstone Plateau volcanic field. Caldera-forming eruptions from three overlapping areas created a large hole in central Yellowstone National Park. The only trace that remains of the rim of this caldera lies beyond the southern border of the park, and west into Island Park, Idaho.

The three cycles were some of the most catastrophic eruptions in the history of the North American continent:

- **Huckleberry Ridge:** Formed during the first eruptive cycle of the Yellowstone Plateau volcanic field, approximately 2 million years ago, this was the largest and most catastrophic eruption.

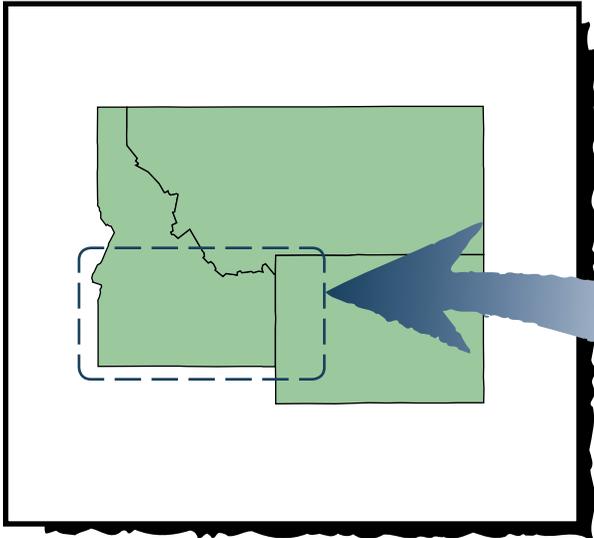
- **Mesa Falls:** Formed during the second eruptive cycle, 1.2 million years ago, the remains of this caldera can be found in Island Park, Idaho.

- **Lava Creek:** Formed during the third eruptive cycle, 600,000 years ago, this is the caldera in present day Yellowstone National Park.

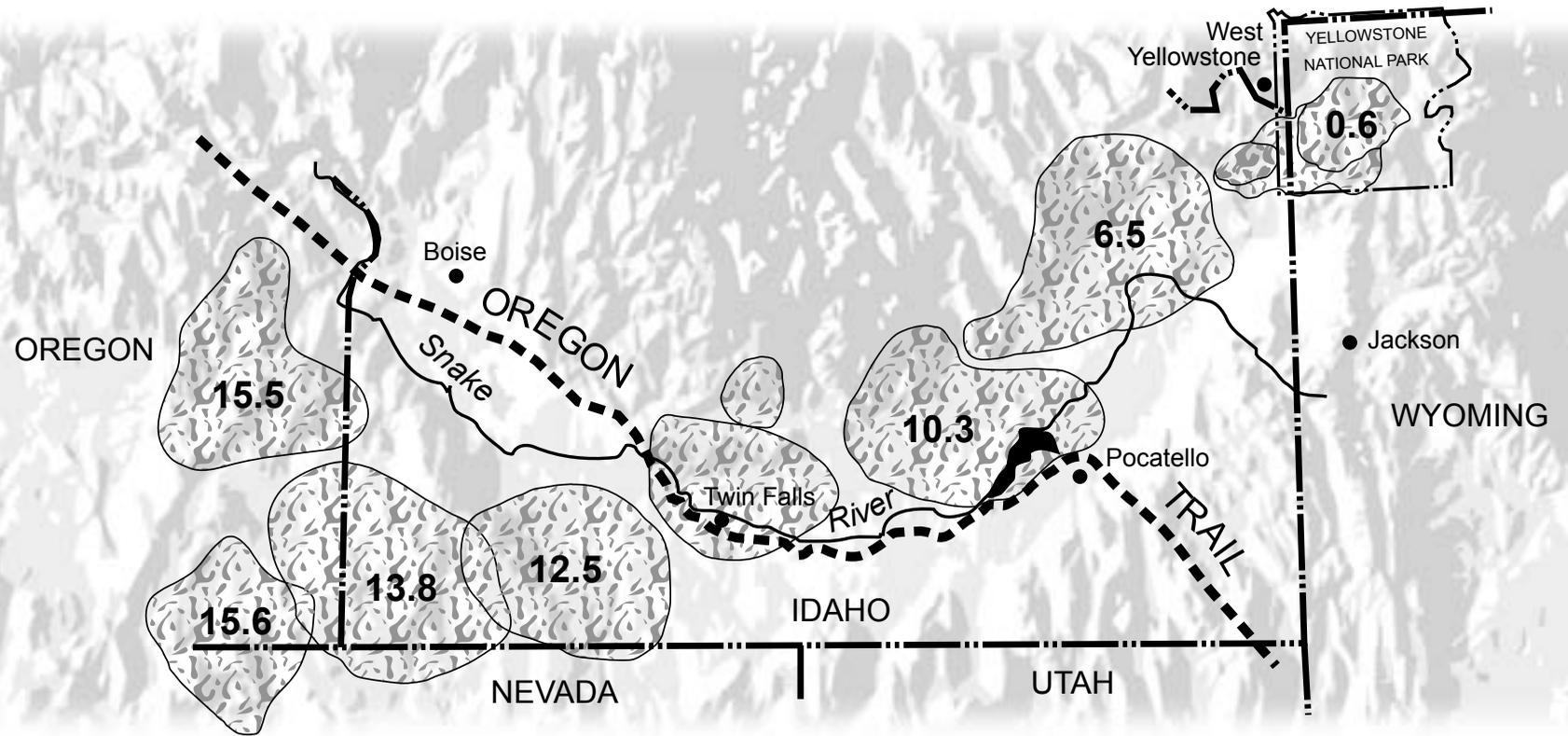
- **Resurgent Domes:** There are two domes of magmatic activity within Yellowstone National Park that show periodic uplift and decline. These are the Mallard Lake Dome and the Sour Creek Dome. Rising at the rate of 19.5 millimeters per year until 1984, the domes are now subsiding at up to 35 millimeters per year. Much of the thermal activity in Yellowstone National Park is situated around the base of these domes.

◆ **FRANCIS BOYD:** As seen in the IMAX movie "Yellowstone," a young graduate student from Harvard hypothesized that Yellowstone might be a giant collapsed crater of a not-so-extinct volcano—a massive caldera. He presented this radical hypothesis in a doctoral thesis. Remarkably, he was right.

VICINITY MAP



TRACK OF THE YELLOWSTONE HOT SPOT



Track of volcanic activity across the Snake River Plain as the Continental Plate moves across the Yellowstone Hot Spot. Shaded areas show calderas and volcanic fields. Numbers within the fields show approximate ages in millions of years. The locations of the Snake River and the Oregon Trail are also shown.



WATERSHEDS

Snake River Basin

◆ **HENRY'S FORK:** Big Springs is one of the 40 largest springs in the United States. Spectacular waterfalls include Upper and Lower Mesa Falls in the Targhee National Forest, and on the tributary Falls River, Cave Falls in Yellowstone National Park.

◆ **SNAKE RIVER:** Idaho Falls, Twin Falls, and Shoshone Falls.

Lost River System

◆ **CREEKS:** Draining the south side of the Centennial and Bitterroot Mountains, Camas, Medicine Lodge, and Birch Creeks all disappear into the lava flows of the Snake River Plain.

◆ **BIG LOST RIVER AND LITTLE LOST RIVER:** Named because they disappear into the lava flows of the Snake River Plain, the Big and Little Lost Rivers flow through the floors of broad valleys, Basin and Range fault blocks that dropped as the adjacent mountain ranges rose.



◆ **THOUSAND SPRINGS:** The north wall of the Snake River Canyon “weeps” due to basalt lava flows that absorb surface water along the northern edge of the Snake River Plain. The waters of the Big and Little Lost Rivers percolate southward through porous zones in between the lava flows. They emerge at Thousand Springs, which discharges approximately 600 cubic feet of water per second.

Missouri River Basin

◆ **THREE FORKS:** The Jefferson, Madison, and Gallatin Rivers meet here, approximately 110 miles northwest of Yellowstone National Park, to form the Missouri River. These rivers were named by the Lewis and Clark expedition.

◆ **JEFFERSON RIVER** (named after U.S. President, Thomas Jefferson): Originates from the Bighole, Beaverhead, and Ruby Rivers, draining the north side of the Bitterroot and Centennial Mountains.

◆ **MADISON RIVER** (named after then U.S. Secretary of State, James Madison): Originates at the confluence of the Gibbon and Firehole Rivers in Yellowstone National Park.

◆ **GALLATIN RIVER** (named after U.S. Secretary of the Treasury, Albert Gallatin): Begins in the Gallatin Range in Yellowstone National Park.

◆ **YELLOWSTONE RIVER:** Originates in the Bridger-Teton National Forest just south of Yellowstone National Park, this river flows more than 500 miles before joining the Missouri River.

TRAILS & SETTLEMENTS

Nez Perce Trail

Pursued by General Howard and the U.S. Cavalry, Chief Joseph and the Nez Perce fled along the rugged Continental Divide through Idaho, Montana, and Yellowstone National Park before surrendering at the Battle of the Bears Paw Mountains in north Montana.

Lewis and Clark Trail

Following the Missouri River to Three Forks, Lewis and Clark followed the Jefferson River into the Bitterroot Mountains. Interpretive centers along the Lewis and Clark trail include Lolo Pass and Lost Trail Pass Visitors Centers in the Clearwater National Forest.

Trail of Wilson Price Hunt Party

As seen in the IMAX movie “Yellowstone,” they were in search of an overland route to the Pacific. This party discovered a route alternate to that of Lewis and Clark. Crossing the Continental Divide to the south, rather than the north, they skirted the Tetons and boundaries of the Yellowstone region, following the Snake and Columbia Rivers to present day Astoria, Oregon.

Oregon Trail

◆ **SOUTH PASS:** Following the North Platte River, settlers were able to pass through the Rocky Mountains via South Pass, one of the most pristine segments of the Oregon Trail. Just off the highway is South Pass City, a ghost town from Wyoming’s gold rush of 1867-68, featuring restored and preserved buildings and historic displays.

◆ **OREGON TRAIL INTERPRETIVE CENTER, BAKER CITY, OREGON:** The Oregon Trail Interpretive Center at Flagstaff Hill, five miles east of Baker City, is a 23,000-square foot state-of-the-art, hands-on, historical time tunnel that beckons visitors into a stunning re-creation of life during the great migration.

◆ **EASTERN IDAHO VISITOR INFORMATION CENTER:** The Bureau of Land Management, U.S. Forest Service, and the Greater Idaho Falls Chamber of Commerce, provides outstanding interpretive exhibits on the Snake River Plain and outlying areas.

Bozeman Trail

◆ **FORT LARAMIE, WYOMING:** Established as a fur trading post in 1834, Fort Laramie later became a significant trail outpost. The U.S. military purchased the fort in 1849 to use as a base for protecting the emigrants during the Indian Wars on the Western Plains.



◆ **VIRGINIA CITY, MONTANA:** In the 1860’s, Virginia City was the gold mining and territorial capital of Montana. Now, this restored mining settlement features historic hotels and period shops.

◆ **NEVADA CITY, MONTANA:** Gold mining settlement featuring a fully restored mining camp. The entire town has been refurbished into an open air museum.

Other

◆ **MUSEUM OF THE ROCKIES, BOZEMAN, MONTANA:** Natural history museum featuring permanent dinosaur, Native American, western history, and geology exhibits, and a planetarium.

◆ **BUFFALO BILL HISTORICAL CENTER, CODY, WYOMING:** Focusing on the Wild West, this center includes the Cody Firearm Museum, the Buffalo Bill Museum, the Whitney Gallery of Western Art, and the Plains Indian Museum.

◆ **NATIONAL MUSEUM OF WILDLIFE ART, JACKSON, WYOMING:** This permanent collection consists of more than 1,600 works of art and spans a 170-year period. Subject matter reflects wildlife, wildlife habitat, and other western topics.