

Stop #7: Thurmon Ridge & the Centennial Mountains
(pull off in large pullout at the byway/ US-20 junction)

For the final stop, look north towards Island Park. The low ridge in the foreground is Thurmon Ridge. Like our first stop, Big Bend Ridge, Thurmon Ridge marks the rim of another one of Yellowstone's caldera-forming eruptions. Specifically, it was created by the second eruption, which was also the smallest of the 3 major eruptions (it was, however, still over 280 times larger than the 1980 eruption of Mt. Saint Helens), creating the Yellowstone II caldera. The northern rim of the Yellowstone I caldera (the one that created Big Bend Ridge) would also exist near here, however it was obliterated by the formation of the Yellowstone II Caldera. Looking further north past the ridge, you will see tall, rugged, often snow-capped peaks dominating the skyline. These are the Centennial Mountains along the Montana-Idaho border, which also happens to be the continental divide in this area. Like the Teton Mountains seen earlier, the Centennials too are a product of an active normal fault, located on the Montana side. Unlike the Tetons and other ranges in the area though, the Centennials trend almost directly east-west, not northwest-southeast. The exact reasoning for this remains unclear, but is possibly related to the thermal bulging of the Yellowstone Hotspot. The uplift from this normal fault is also responsible for damming several creeks that drain out of the Henry's Lake Mountains, creating Henry's Lake. The Centennials are likely a very young mountain range. We can surmise this because ash-flow deposits from the first Yellowstone eruption can be found on both sides of the mountains, and since ash flows can't flow uphill to cross a mountain range, this particular range did not exist 2 million years ago. Rising to more than 10,000 ft. in elevation, the uplift of the Centennials to their present height in less than 2 million years is indeed impressive!

Want to learn more?

For further reading, we strongly suggest picking up a copy of *Roadside Geology of Yellowstone Country* by William J. Fritz & Robert C. Thomas. *Roadside Geology of Idaho* by David Alt & Donald Hyndman is also good. These books can be found in many gift shops throughout the region.

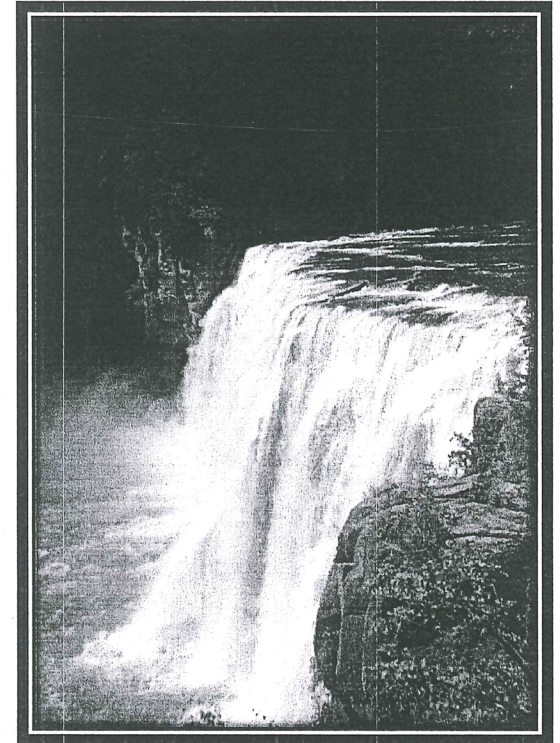
Mesa Falls Visitor Center

(located at Upper Mesa Falls)
Open daily 10:00 a.m. to 5:30 p.m.
mid-May through mid-September

Caribou-Targhee National Forest
Ashton/Island Park Ranger District
Attn: Mesa Falls Recreation Area
P.O. Box 858
Ashton, ID 83420
208-652-7443



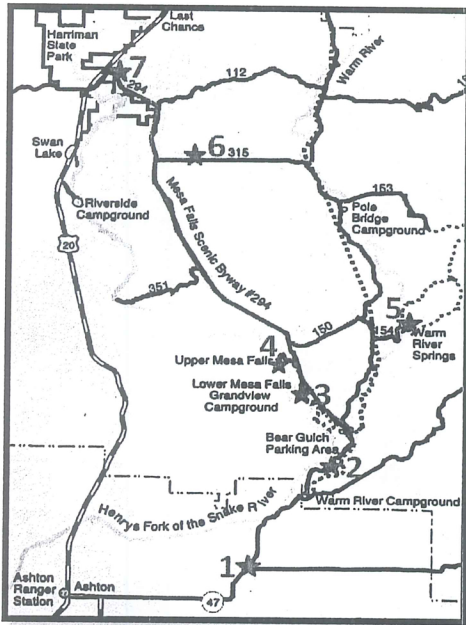
**Geology of the
Mesa Falls
Scenic Byway**



**See firsthand the spectacular results of
one of America's most geologically
active regions!**



Welcome to the Mesa Falls Scenic Byway! This 30-mile scenic drive through Eastern Idaho's Island Park region showcases many parts of the Greater Yellowstone Region's amazing geology, including, but not limited to, the name-sake Mesa Falls. This road guide starts on the south end of the byway in Ashton and finishes at the north end of the byway at its intersection with US Highway 20. If you're starting from the north end, simply read the stops in reverse.

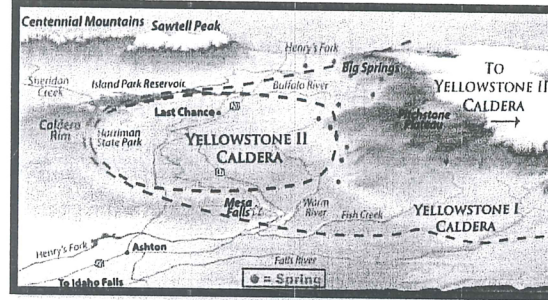


Stop #1: Big Bend Ridge

(pull off the road near the junction with Cave Falls Road)

The large forested ridge to your north is actually the rim of an old volcano! 2.1 million years ago ("Ma" for short), the first & largest of 3 major eruptions in the Yellowstone area occurred, erupting over 600 cubic miles of ash- that is 2,500 times larger than the 1980 Mt. St. Helens eruption! Giant eruptions like this occur when the overlying rock can no longer hold in the pressure of the underlying magma, causing the magma to explosively erupt. Once the magma chamber empties, the overlying rocks collapse into the large void left by the magma chamber, creating a large, usually semi-circular crater called a *caldera*. Each of the 3 major eruptions in Yellowstone have left a caldera in their wake. For the sake of simplicity, we refer to

them here as the Yellowstone I, II, & III calderas, with I being the oldest (2.1 Ma) and III being the youngest (.7 Ma).



Stop #2: Teton Overlook

(pull into the signed pull-out near the top of Warm River Hill)

Those tall, jagged mountains that were in front of you for much of the drive across the farm fields east of Ashton, and which are visible again from this overlook are none other than the mighty Teton Range of Grand Teton National Park! The Tetons are a very young mountain range, at least geologically speaking. The mountains you see now have been uplifted along a normal fault—a type of fault that causes the mountains to rise while at the same time dropping the adjacent valley—within the past few million years. This is why they look so "Grand" from the Jackson Hole Valley! This fault, as well as many others throughout southwest Montana & eastern Idaho, is still very much active, and has the potential to produce a quake just as large (or even larger!) than the 1959 Hebgen Lake earthquake. Even more recently—as recent as 12,000 years ago—giant ice-age glaciers scoured the ancient 2.5 billion year-old rock that makes up the Teton Range, creating large U-shaped valleys as well as steep, pointy peaks called *glacial horns*. The peaks you see from the overlook- the 3 Tetons (Grand, Middle, & South) are all excellent examples of glacial horns.

Stop #3 & 4: Lower & Upper Mesa Falls

Upper & Lower Mesa Falls are the last 2 un-altered/un-dammed waterfalls left on a major river in the Snake River drainage, and are among the tallest un-altered waterfalls in the entire Columbia River drainage—only Kootenai Falls in the northwestern corner of Montana are taller. Both Lower (65 ft. tall) & Upper (114 ft. tall) flow over a type of rock called the *Mesa Falls Tuff*. This rock was created by the second major Yellowstone eruption 1.3 Ma. During the eruption, large amounts of still-molten ash from the erupting rhyolite lava came flowing off of the volcano in "glowing avalanches" that often

exceeded speeds of 500 mph! The ash particles, still partially molten after they settled, fused together densely to form the hard, erosion-resistant rock called Mesa Falls Tuff. But the story of the waterfalls doesn't end there! More recently, roughly 30,000 years ago, several basalt lava flows erupted from a vent just north of the falls. Basalt, unlike rhyolite, is a very "runny" lava, about the consistency of ketchup (rhyolite, on the other hand, is thicker than silly putty). Thus, it has a tendency to flow, like water, and often follows the same course as streams and rivers, as it did in this case, filling up the Henry's Fork Canyon! This pushed the Henry's Fork River over and forced it to carve a new canyon between the basalt and the older Mesa Falls Tuff, which is why we see different rocks on each side of the canyon today!

Stop #5: Warm River Springs

(turn right ~1 mile north of Upper Mesa Falls at sign for Warm River Springs and Forest Road 150/154 and travel ~5 miles to the spring)

One of several large springs in the Island Park area, this spectacular gushing spring, like the more well-known Big Springs further north, is fed by water emerging from the base of the obsidian lava flows that make up Yellowstone's Pitchstone Plateau. Rain and snowmelt trickling down through the flow eventually hits an impermeable layer at the base of the flow, where it then flows horizontally, emerging in large springs such as Warm Springs and Big Springs at the edge of the plateau.

Stop#6: Osborne Butte Lava Dome

(travel north on the byway from the Warm Springs turnoff another ~4 miles to North Hatchery Butte Road. Turn right and travel ~1/2 mile to tree covered hill on your left.)

The big tree-covered hill to your north is a 1.2 million year old lava dome that formed on the floor of the Yellowstone II caldera ~100,000 years after the caldera-forming eruption. As mentioned earlier, rhyolite is a very "sticky" lava. This means unless there are a lot of gasses in it to cause it to erupt explosively, it will just ooze out & pile up close to the vent due to its inability to flow, forming "domes" of lava. This is just one of a handful found throughout the Ashton/Island Park area. The relatively large, shiny crystals that are so abundant in this rhyolite are Potassium Feldspar. Several varieties of feldspar are major minerals in nearly every type of lava.