

What Would Happen If Yellowstone's Supervolcano Erupted?

By Becky Oskin, Contributing Writer | May 02, 2016 07:31am ET

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Hot springs in Yellowstone National Park are just one of the types of thermal features that result from volcanic activity.

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Although fears of a Yellowstone volcanic blast go viral every few years, there are better things to worry about than a catastrophic supereruption exploding from the bowels of Yellowstone National Park.

Scientists at the U.S. Geological Survey's (USGS) Yellowstone Volcano Observatory always poo-h-poo these worrisome memes, but that doesn't mean researchers are ignoring the possible consequences of a supereruption. Along with forecasting the damage, scientists constantly monitor the region for signs of molten rock tunneling underground. Scientists scrutinize [past supereruptions](#), as well as smaller [volcanic blasts](#), to predict what would happen if the Yellowstone Volcano did blow.

Here's a deeper look at whether Yellowstone's volcano would fire up a global catastrophe.

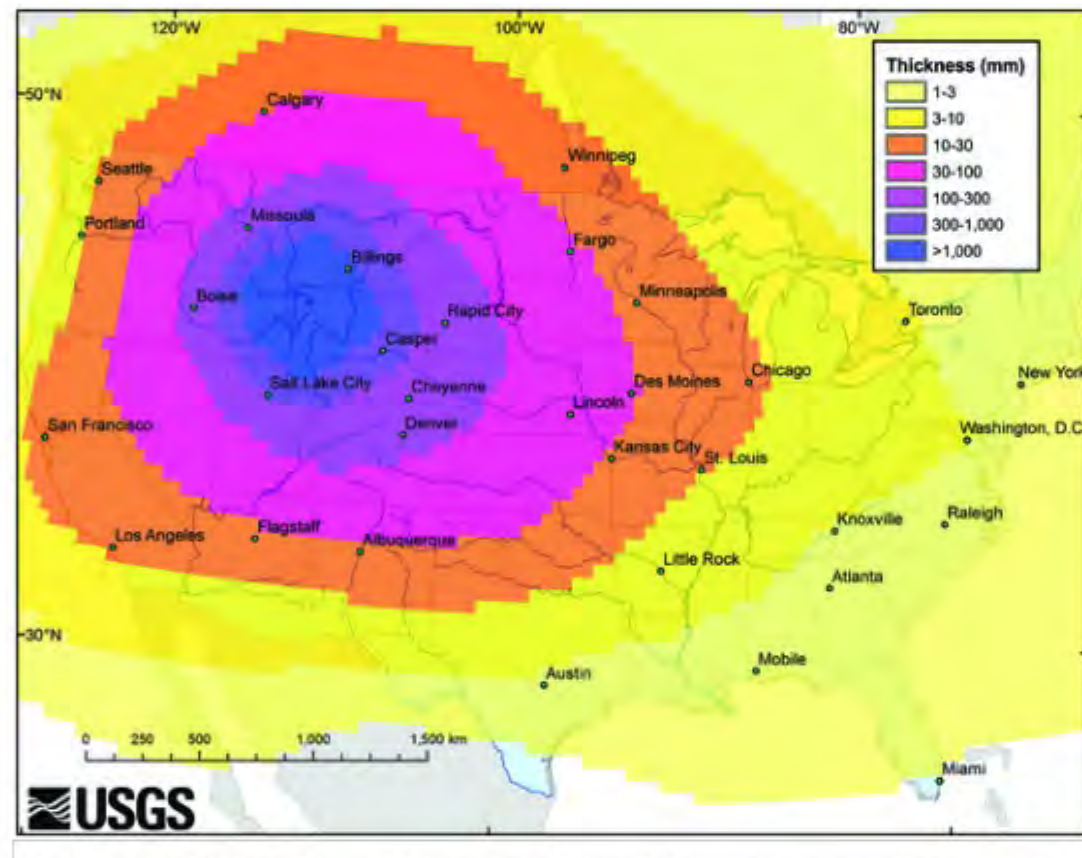
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Probing Yellowstone's past

Most of Yellowstone National Park sits inside [three overlapping calderas](#). The shallow, bowl-shaped depressions formed when an underground magma chamber erupted at Yellowstone. Each time, so much material spewed out that the ground collapsed downward, creating a caldera. The massive blasts struck 2.1 million, 1.3 million and 640,000 years ago. These past eruptions serve as clues to understanding what would happen if there was another Yellowstone megaexplosion. [\[Yellowstone and Yosemite: Two of the World's Oldest National Parks \(Photos\)\]](#)



An example of the possible ashfall from a month-long Yellowstone supereruption.

Credit: USGS/View full size image

If a future supereruption resembles its predecessors, then flowing lava won't be much of a threat. The older Yellowstone lava flows never traveled much farther than the park boundaries, [according to the USGS](#). For volcanologists, the biggest worry is wind-flung ash. Imagine a circle about 500 miles (800 kilometers) across surrounding Yellowstone; studies suggest the region inside this circle might see more than 4 inches (10 centimeters) of ash on the ground, scientists reported Aug. 27, 2014, in the journal [Geochemistry, Geophysics, Geosystems](#).

The ash would be pretty devastating for the United States, scientists predict. The fallout would include short-term destruction of Midwest agriculture, and rivers and streams would be clogged by gray muck.

People living in the Pacific Northwest might also be choking on Yellowstone's fallout.

"People who live upwind from eruptions need to be concerned about the big ones," said Larry Mastin, a USGS volcanologist and lead author of the 2014 ash study. Big eruptions often spawn giant umbrella clouds that push ash upwind across half the continent, Mastin said. These clouds get their name because the broad, flat cloud hovering over the volcano resembles an umbrella. "An umbrella cloud fundamentally changes how ash is distributed," Mastin said.

But California and Florida, which grow most of the country's fruits and vegetables, would see only a dusting of ash.

A smelly climate shift

Yellowstone Volcano's next supereruption is likely to spew vast quantities of gases such as [sulfur dioxide](#), which forms a sulfur aerosol that absorbs sunlight and reflects some of it back to space. The resulting climate cooling could last up to a decade. The temporary climate shift could alter rainfall patterns, and, along with severe frosts, cause widespread crop losses and famine.



The walls of the Grand Canyon of Yellowstone are made up predominantly of lava and rocks from a supereruption some 500,000 years ago.

Credit: USGS/View full size image

But a Yellowstone megablast would not wipe out life on Earth. There were no extinctions after its last three enormous eruptions, nor have other [supereruptions triggered extinctions](#) in the last few million years. [\[Wipeout: History's 7 Most Mysterious Extinctions\]](#)

"Are we all going to die if Yellowstone erupts? Almost certainly the answer is no," said Jamie Farrell, a Yellowstone expert and assistant research professor at the University of Utah. "There have been quite a few supereruptions in the past couple million years, and we're still around."

However, scientists agree there is still much to learn about the global effects of supereruptions. The problem is that these massive outbursts are rare, striking somewhere on Earth only once or twice every million years, [one study found](#). "We know from the geologic evidence that these were huge eruptions, but most of them occurred long enough in the past that we don't have much detail on what their consequences were," Mastin said. "These events have been so infrequent that our advice has been not to worry about it."

A far more likely damage scenario comes from the less predictable hazards — large earthquakes and [hydrothermal blasts](#) in the areas where tourists roam. "These pose a huge hazard and could have a huge impact on people," Farrell said.

Supereruption reports are exaggerated

Human civilization will surely survive a supereruption, so let's bust another myth. There is no pool of molten rock churning beneath Yellowstone's iconic geysers and mud pots. The Earth's crust and mantle beneath Yellowstone are indeed hot, but they are mostly solid, with small pockets of molten rock scattered throughout, like water inside a sponge. [About 9 percent of the hot blob is molten](#), and the rest is solid, scientists reported on May 15, 2015, in the *Journal of Science*. This magma chamber rests between 3 to 6 miles (5 to 10 km) beneath the park.

Estimates vary, but a magma chamber may need to reach about 50 percent melt before molten rock collects and forces its way out. "It doesn't look like at this point that the [Yellowstone] magma reservoir is ready for an eruption," said Farrell, co-author of the 2015 study in the *Journal of Science*. [\[Can You Outrun a Supervolcano? Maybe, Study Finds\]](#)

How do researchers measure the magma? Seismic waves travel more slowly through hot or partially molten rock than they do through normal rock, so scientists can see where the magma is stored, and how much is there, by mapping out where seismic waves travel more slowly, Farrell said.

The magma storage region is not growing in size, either, at least for as long as scientists have monitored the park's underground. "It's always been this size, it's just we're getting better at seeing it," Farrell said.

Watch out for little eruptions

As with magma mapping, [the science of forecasting volcanic eruptions](#) is always improving. Most scientists think that magma buildup would be detectable for weeks, maybe years, preceding a major Yellowstone eruption. Warning signs would include distinctive earthquake swarms, [gas emissions](#) and rapid ground deformation.

Someone who knows about these warning signals might look at the park today and think, "Whoa, something weird is going on!" Yellowstone is a living volcano, and there are always small earthquakes causing tremors, and gas seeping from the ground. [The volcano even breathes](#) — the ground surface swells and sinks as gases and fluids move around the volcanic "plumbing" system beneath the park.

But the day-to-day shaking in the park does not portend doom. The Yellowstone Volcano Observatory has never seen warning signs of an impending eruption at the park, according to the USGS.

What are scientists looking for? For one, the distinctive earthquakes triggered by moving molten rock. Magma tunneling underground sets off seismic signals that are different from those generated by slipping fault lines. "We would see earthquakes moving in a pattern and getting shallower and shallower," Farrell said. To learn about the earthquake patterns to look for, revisit [the 2014 eruption of Bardarbunga Volcano](#) in Iceland. Both amateurs and experts "watched" Bardarbunga's magma rise underground by tracking earthquakes. The eventual surface breakthrough was almost immediately [announced on Twitter](#) and other social media. As with Iceland, all of [Yellowstone's seismic data](#) is publicly available through the U.S. Geological Survey's Yellowstone Volcano Observatory and the University of Utah.

"We would have a good idea that magma is moving up into the shallow depths," Farrell said. "The bottom line is, we don't know when or if it will erupt again, but we would have adequate warning."

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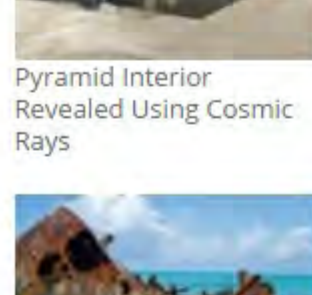
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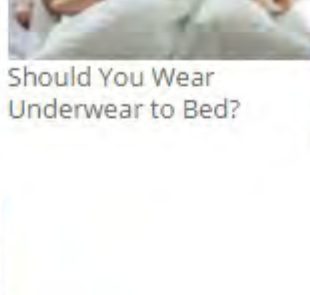
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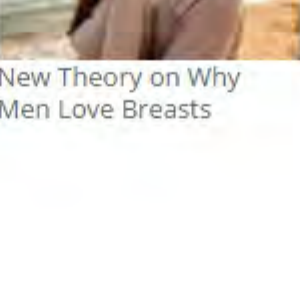
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