

Yellowstone supervolcano a local threat, too

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Imagine a thick fog closing in on the city.

As you step outside under the blotted sun, you're covered in sharp, grey particles that blanket the streets.

Scientists have discovered Yellowstone National Park supervolcano is two-and-a-half times larger than previously thought, and it could erupt with 2,000 times the force of Mount St. Helens — a blast that would devastate North America and dump upwards of 10 cm of ash on Edmonton.

The national park and surrounding communities would be annihilated, while plants and entire farms would be wiped out in surrounding states. Escape would be futile — ash damages commercial aircraft engines, making flight hazardous.

Sulfur entering the upper atmosphere would turn to sulfur dioxide, circling the globe and spurring a drop in temperature, and worldwide famine would likely ensue.

"There's not a whole lot you could do," said Jamie Farrell with the department of geology and geophysics at the University of Utah.

"Once this thing revs up, there's nothing you can do to stop it."

Farrell is the lead author of a study presented at the American Geophysical Union Fall Meeting in San Francisco in December that determined the magma chamber beneath the Yellowstone caldera is 88 km long and 29 km wide, reaching depths up to 15 km. That makes it the largest imaged magma reservoir in the world.

But is an eruption in the cards? No one really knows.

"There may not be, but there probably will be. Of course, we don't know when," Farrell said.

The popular Wyoming tourist destination lies on a depression in the ground created by a major eruption 640,000 years ago. The hot springs, boiling

mud and geysers that dazzle visitors are merely a glimpse into the molten rock that stirs below.

Farrell's team carefully monitors the "living, breathing" volcano using seismic tomography — essentially a giant CAT scan — to measure seismic waves, with 35 seismometers running continuously.

Even with constant monitoring and advanced technology, Farrell says warning of the eruption might only come days in advance.

Researchers have a rough picture of what the blast would look like, based on smaller eruptions, but mankind has never seen anything matching Yellowstone's potential destructive force.

"Nobody, since we've been on this planet, has witnessed one of these large volcanic eruptions," Farrell said.

The biggest in modern times was Mount Tambora in Indonesia, which blew in 1815. Ash dimmed the sun for close to a year afterward and temperatures dropped an average of 0.5 C worldwide. The resulting crop failures led to 1816 being dubbed, "The Year Without a Summer." Famine broke out across Europe, China and North America, while bizarre weather patterns included red snow in Italy and a 30-centimetre snow dump in Quebec in June.

The last documented supervolcano eruption was roughly 74,000 years ago in present-day Lake Toba in Indonesia, and scientists are still trying to measure its cost to human life.

The blast is thought to have dropped global temperatures 3 C to 5 C and caused a decade-long volcanic winter that coincided with the onset of the last glacial period.

"They think that it basically wiped out 90% of our early ancestors. They infer that it was that destructive," said Martyn Unsworth, professor of physics and earth and atmospheric sciences at the University of Alberta.

"We've not seen them happen and it's kind of a steep learning curve. When the first (supervolcano) happens, it's going to take people by surprise."

A full-force Yellowstone eruption would probably kill millions and make much of North America uninhabitable.

Yellowstone tends to have a major eruption every 600,000 to 700,000 years — numbers determined by ash deposits aged using geochemical and radioactive dating — and Unsworth said another one might not be far off.

“It’s been doing it about every 600,000 years and the last one was about 600,000 years ago. I can’t call that a prediction, but some would say it’s a cause to be concerned about the next one coming,” he said.

Unsworth, who has also worked at Seattle University, said a series of small earthquakes typically precedes a volcanic eruption. When magma and pressure is building, there is usually “some kind of straw that breaks the camel’s back,” he said. When Mount St. Helens in Washington blew in 1980, the final straw was a small, magnitude-6 earthquake.

However, supervolcanoes behave differently.

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“These really big ones get into a mode where they can just grow monstrous, almost like an abscess, and it just burrows its way through the earth’s crust ... The thing is rising buoyantly and the roof is just too broad a span to be supported, and the (10-km thick) roof will fall in like a trap door and the magma can just vaporize and boil,” Unsworth explained.

“It’s like taking the top off of a Coke bottle that you’ve been shaking forever, because you’ve kept the gas under pressure and suddenly when the roof’s gone, the stuff will just be fizzing and essentially boiling, and producing millions of tonnes of ash.”

Ash would be the first visible impact north of the border and, Unsworth said, 10 cm is a “conservative estimate” of what Edmonton would get, though much would depend on wind direction.

An explosion in Oregon’s Cradle Lake area 6,000 years ago left a layer of ash in Edmonton’s North Saskatchewan River Valley that can still be seen today.

“It’s not just like snow, it’s obviously a lot heavier and it gets in everything electronic — like a computer with a fan, cars,” he said. “It’s these small, sharp particles. I think the biggest health hazard is not to the people that get killed by the eruption, it’s the people that are breathing this in.”

A massive eruption could be positive in the long term, as volcanic ash eventually raises soil fertility. But the world’s population might never recover from the catastrophic ecological and economic repercussions of the blast.

“The chance per year of Yellowstone blowing up — eh, they’re low,” Unsworth said. “But it’s potentially going to happen sooner or later.”

Earthquakes, not volcanoes, pose the greatest threat to Yellowstone National Park, according to researchers.

“It’s not just a volcanic threat. There’s a seismic threat as well,” said Jamie Farrell with the University of Utah, the lead author of a Yellowstone study that was presented at the 2013 American Geophysical Union Fall Meeting in San Francisco.

While Yellowstone’s last volcanic eruption happened 70,000 years ago and the last major eruption occurred 640,000 years ago, the area’s last deadly quake struck in 1959.

The 7.3-magnitude earthquake in Madison Canyon, Montana, 15 km west of Yellowstone, was felt in Idaho and Wyoming and killed at least 28 people.

The 30-second quake and following shockwaves created hurricane-strength winds that tossed people and vehicles, uprooted trees, and collapsed roads and highways into the river.

The Madison River’s flow was completely blocked, creating Quake Lake.

“Of course, back then there weren’t as many people visiting Yellowstone as there is now, so if something like that happens these days I think there would be a lot more people affected,” Farrell said.

When researching to build a picture of Yellowstone’s underground magma reservoir, Farrell and his team analyzed more than 4,500 earthquakes that hit the area between 1985 and 2013.

Yellowstone is constantly trembling — small, 1-2 magnitude earthquakes are a daily occurrence.

According to the Yellowstone Volcano Observatory, large and moderate earthquakes and hydrothermal explosions are “certain to occur” within the next few decades.

—Maimann

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