Transcript of U.S. Geological Survey Open-File Report 2009-1067, Three short videos by the Yellowstone Volcano Observatory, video 1, 'Yes! Yellowstone is a Volcano.'

[Music playing]
[graphic of logo: USGS, science for a changing world]

Yes! Yellowstone is a volcano
An unscripted interview, January 2009, 7:00 Minutes

[video of geologist standing in front of a large geologic map of Yellowstone while he talks to the camera and points out features on the map]

Yes, Yellowstone is a volcano. My name is Jake Lowenstern and I work for the U.S. Geological Survey. I'm the Scientist-in-Charge of the Yellowstone Volcano Observatory and that's a partnership with the USGS, the University of Utah who does the actual monitoring of the earthquakes and ground movement, and the land manager Yellowstone National Park. [logos of three agencies in the corner]

How do we know that Yellowstone is a volcano?

We're looking here at a Geologic map of Yellowstone National Park and the different colors represent different geologic units, different rock types, different ages of rocks. You can see that all of the pink units in here, these represent the youngest lava flows mostly that erupted at the Yellowstone volcano. [1:00 minutes] Most of these are between about160 and 70,000 years old. And we see that they're covering up this area of the park.

It turns out this is the Yellowstone caldera. It starts around here and it moves out into the area over here and it is about 50 miles long and it formed when this green material erupted. This is called the Lava Creek Tuff and the age of this unit is found here in the light green and dark green, also to the south. The age is 640,000 years. This was an enormous eruption and it spread ash over much of the United States [graphic showing map of US with ash spread from offshore LA to offshore Louisiana to nearly Illinois, and into Canada] and a similar eruption to that today would certainly be a big deal. But since this time, there have been about 80 different eruptions at Yellowstone. Some of them are very big. This one is the most recent, 70,000 years old and it's called the Pitchstone Plateau lava flow. In fact, the size of it is about the size of Washington DC, and it's about 100 yards thick in most places. So this is what we're looking at. We can see volcanic rocks everywhere, evidence that this is a really unusual place. [2:00 minutes] It's a massive volcano.

What is a Supervolcano?

Some of the eruptions from Yellowstone are truly enormous eruptions, some of the largest ones that are know of on Earth. That includes this green unit here, the Lava Creek Tuff, as well as the purple unit which is the Huckleberry Ridge Tuff which is erupted 2.1 million years ago. So these are some of the largest eruptions that we know of on Earth

and because they erupted so much material on the order of about 1000 cubic kilometers or 250 cubic miles, then they get termed as "super eruptions," really big eruptions and the way that it works, this is kind of a new terminology, and super eruptions, if you're a volcano that has exploded and created one of these deposits, then you get called a "supervolcano" and that's where the word supervolcano comes from.

What is a Caldera?

[3:00 minutes] To have this magma that's beneath the surface and when it erupts and comes out, there's no longer support for the ground surface up here, and as a result, the ground surface just caves in. It founders and it falls in. [video of model caldera collapse made with baking flour] You're left with what's called a caldera. It's a subsidence feature, a cave in feature, that's caused when it loses its support of the underground magma. And as a result, when it first formed, you had a hole that was on the order of 50 miles long and maybe even 1000, or 2000, or 3000 feet deep in places.

Why are there geysers at Yellowstone?

We have this deep magma chamber and there's a lot of heat. The magma is generally at temperatures like 700-800 degrees centigrade or something like 12-1300 degrees Fahrenheit. There's a lot of heat. That heat heats up the rock and that rock then there's conductive cooling, there's water down there. [4:00 minutes] That water gets heated up and so much of the water that's near the surface at Yellowstone is actually at boiling temperature and as you go down, it gets hotter and hotter. So that creates a pressurized system of boiling aquifer, boiling groundwater and that becomes unstable. [set of photographs of geysers] It can cause earthquakes and of course, it causes the thermal features that we see everywhere at Yellowstone and that make Yellowstone so famous-- the geysers, the fumeroles, or steam vents, the hot springs that are so beautiful and contain so many kinds of life and thermafile bacteria. So that's what makes Yellowstone special and it's pretty much all due to this underground magma system.

Some other Geologic hazards in Yellowstone

So we have these massive eruptions that are really quite rare and then we have these lava flows that happen more frequently but still not…the last one was 70,000 years ago. But this would be a really big event if it happened again within the park. [5:00 minutes] It might cause forest fires, it might dam up rivers, and it would cause a lot of commotion and anxiety within Yellowstone, but it would have very little long-range effect. It wouldn't affect people in states that are hundreds of miles away certainly. We have other big events that occur at Yellowstone-- for example, earthquakes. In 1959, there was a magnitude 7.5 that occurred out near Headkin Lake, [photograph of landslide; photograph of the Tetons] caused a lot of damage in the park and also caused a lot of changes to the thermal areas within Yellowstone.

The Teton fault is on the border of the Teton Mountains south of the Park and it potentially could have a very big earthquake associated with it.

Beyond that, we have the hydrothermal explosions or steam explosions when the groundwater system becomes too pressurized and erupts during some sort of a perhaps an earthquake or due to a change in lake level. And what happens is that you get the groundwater system can cause really large holes in the ground, sometimes hundreds of feet across. [6:00 minutes] This is a turbid lake right here, Indian Pond and Mary Bay. [photo of blue pond taken from the air] All of these were created in the last 15,000 years by explosions of the hydrothermal system. In this case no magma's erupted, and they're fairly localized events in terms of their damage, but they're still definitely relevant for what's going on at Yellowstone and need to be watched.

Almost every year, somewhere in Yellowstone, there's a small hydrothermal explosion. Sometimes they may only be a couple feet across, but we find evidence for them. Sometimes we see a little bit of smoke coming out or fumes coming out in a place we didn't expect it. Sometimes somebody hears it. And in lucky cases, we actually get to witness one of these explosions and that's happened every few years as well. We have no way of predicting these explosions, especially the small ones, but we hope that as time goes by, [7:00 minutes] we'll get more and more knowledge about how they work and maybe get the chance that some day, we'll be able to have some predictive capabilities for these explosions.

[Music playing]
[credits]

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Featuring Jake Lowenstern, Scientist-in-Charge, Yellowstone Volcano Observatory

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For additional information:
http://volcanoes.usgs.gov
http://volcanoes.usgs.gov/yvo/

[graphic of logo: USGS, science for a changing world]

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