

# Increased Seismic Activity at Yellowstone

Tuesday, 06 January 2009

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Increased Seismic Activity in

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Yellowstone's Super-Volcano

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Updated 1-11-09

Originally posted January 6, 2009

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Above: Yellowstone Park's Volcanic Caldera

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Update: 1-11-9

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MORE SWARMS DEVELOP on 1-9-9

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USGS Statement on 1-9-9

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### Small Earthquake Swarm on 9 January 2009 near northeast corner of Yellowstone Caldera

A currently modest swarm of earthquakes began in the northeast corner of the Yellowstone Caldera, about 10 miles (16 km) NNE of the north end of the Yellowstone Lake swarm that was active in late December and early January. As of 1930 MST, 10 earthquakes had been located by the University of Utah Seismograph Stations, the largest with  $M=3.3$  and two other events with  $M > 2.0$ . Located depths are between 2 and 4 km.

Yellowstone Volcano Observatory staff and collaborators are analyzing the data from this and from the earlier Yellowstone Lake swarm and are checking for any changes to the thermal areas located near the epicenters. We will provide further information as it becomes available.

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### USGS Updated Comment of 1-8-9

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About 900 earthquakes occurred between Dec. 26, 2008 and Jan. 8, 2009 in the Yellowstone Lake area. Five hundred of the earthquakes (including all greater than magnitude 2.0) have been reviewed by seismologists. There were 111 earthquakes with magnitudes greater than 2.0 ( $> M2.0$ ) and 18 earthquakes  $> M3.0$ . About 400 smaller earthquakes have yet to be reviewed. [A new Frequently Asked Question about earthquake analysis will be posted here soon]. The largest earthquake during the swarm was a magnitude 3.9 on Sunday, December 28, 2008. One of the analyses seismologists use to talk about earthquakes and swarms is the cumulative seismic moment, which is a measure of the earthquake energy. The cumulative moment (the energy from all the analyzed earthquakes in the swarm) for the Yellowstone Lake Swarm is equal to the energy of a single magnitude 4.5).

Depths for shallow earthquake hypocenters (the point within the earth where an earthquake rupture starts) are difficult to determine accurately unless the seismic stations are spaced much more closely than those in the Yellowstone Seismic Network. The best located earthquakes have hypocenters (depths) of 3 to 10 km (1.8 to 6.0 miles). From Dec. 26 through Jan 2, the hypocenters appear to have migrated northwards, starting southeast of near Stevenson Island, with many of the latest events occurring near Fishing Bridge.

The recent swarm is well above typical activity at Yellowstone. Nevertheless it is not unprecedented during the last 40

years of monitoring. Earthquake swarms within the Yellowstone caldera are typical, with magnitudes occasionally ranging above 4.0. The 1985 swarm on the northwest rim of the caldera lasted for three months, with earthquakes up to M4.9 and over 3000 total events recorded.

The magnitudes of earthquakes in this swarm range from zero to 3.9. Earthquakes with magnitudes less than 3.4 are generally not felt by people unless they are very shallow and you are standing very close to the epicenter (point on the earth's surface above the hypocenter). For perspective, earthquakes of magnitude 3.4 to 4.5 are often felt and there were multiple reports of felt earthquakes during this swarm. A magnitude 5 or greater is generally required to produce damage to buildings or other structures.

Earthquakes at Yellowstone are caused by a combination of geological factors including:

1) regional stress associated with normal faults (those where the valleys go down relative to the mountains) such as the nearby Teton and Hebgen Lake faults,

2) magmatic movements at depth (>7 kms or 4 miles), and

3) hydrothermal fluid activity caused as the groundwater system is heated to boiling by magmatic heat.

At this time, no one has noted any anomalous changes in surface discharges (hot springs, gas output, etc.).

We continue to monitor Yellowstone Volcano

YVO staff from the USGS, University of Utah and Yellowstone National Park continue to carefully review all data streams that are recorded in real-time. At this time, there is no reason to believe that magma has risen to a shallow level within the crust or that a volcanic eruption is likely. The USGS Volcano Alert Level and Aviation Color Code for Yellowstone remain at Normal and Green.

Yellowstone National Park is evaluating infrastructure near the north end of Yellowstone Lake to assess if any damage has occurred to facilities.

Winter visitor activities and staff operations have not been impacted and continue as normal. [More - LINK HERE.](#)

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Constant Updating Quake List For Yellowstone:

LINK

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Article Below - Posted on 1-6-9

(A-O Newswire) -- Earthquakes are swarming around the Yellowstone National Park area. Yellowstone is home to the world's largest Volcanoe Caldera where perhaps the largest volcanic eruptions in Earth's history have taken place.

The Yellowstone Volcano is so huge and so ancient that it does not appear to be a typical volcano because most volcanos are atop a mountain. Yellowstone however is a super-volcano and at one time was a large mountain but its mountainous height was destroyed by prior eruptions.

Scientists believe that the last eruption of Yellowstone was more than 600 million years ago (a minor eruption 70,000 years ago and an event 13,000 years ago) and is either due or overdue for another eruption over the course of the next few thousands of years or maybe a few million years - OR - maybe this year. No one knows.

Changes in the Yellowstone Park area in the last few years have however, caused geologists to become concerned that Yellowstone's volcanic eruption capability is stirring to life and might erupt again in the very near future. For that reason new monitoring stations have been installed to track development in an attempt to provide some advance notice of an eruption.

In a recent TV documentary broadcast on Cable TV's "The History Channel" - scientists from the Park and USGS researchers admit that for now, Yellowstone might provide only a few hours advance notice of an eruption, if even that much time. However, scientists optimistically think they could or should have at least two weeks to perhaps several months of advance notice, but admit that Yellowstone is unpredictable and that there is still much they do not know about Yellowstone's time-frame for eruption predictions.

Normally, Yellowstone experiences hundreds of small quakes during the course of a year. Since December 26 to January 3 alone, a sudden swarm of 500 small quakes have raised suspicions among some geologists that Yellowstone

might be showing early signs of eruption.

Below is a statement posted by the Yellowstone Volcanic Observatory, on January 3, 2009:

Over 500 earthquakes, as large as M 3.9, have been recorded by an automated earthquake system since the inception of this unusual earthquake sequence that began Dec. 27, 2008. More than 300 of these events have been reviewed and evaluated by seismic analysts. Depths of the earthquakes range from ~ 1km to around 10 km. We note that the earthquakes extend northward from central Yellowstone Lake for ~10 km toward the Fishing Bridge area, with a migration of recent earthquakes toward the north. Some of the dozen M3+ earthquakes were felt in the Lake, Grant Village and Old Faithful areas. P

ersonnel of the Yellowstone Volcano Observatory continue to evaluate this earthquake sequence and will provide information to the NPS, USGS and the public as it evolves. This earthquake sequence is the most intense in this area for some years. No damage has been reported within Yellowstone National Park, nor would any be expected from earthquakes of this size. The swarm is in a region of historical earthquake activity and is close to areas of Yellowstone famous hydrothermal activity. Similar earthquake swarms have occurred in the past in Yellowstone without triggering steam explosions or volcanic activity. Nevertheless, there is some potential for hydrothermal explosions and earthquakes may continue or increase in magnitude. There is a much lower potential for related volcanic activity.

Below is a statement by the Yellowstone Volcanic Observatory dated January 6, 2009

#### Yellowstone Lake Earthquake Swarm Summary as of 6 January 2009

Through 5 January 2009, seismic activity has markedly decreased. It is possible that the swarm has ended, though a return of activity may occur as Yellowstone swarms of the size usually last for tens of days to many weeks.

About 500 earthquakes occurred between Dec. 26 through Jan. 1. Three hundred of the earthquakes (including all >M2.0) have been reviewed by seismologists. There have been 86 earthquakes with  $M > 2.0$  and 16 earthquakes  $> M3.0$ . About 200 smaller earthquakes have yet to be reviewed. Depths are difficult to determine accurately. The best located earthquakes have depths on the order of 3 to 10 km (1.8 to 6.0 miles). From Dec. 26 through Jan 2, the earthquake hypocenters appear to have migrated northwards, starting southeast of near Stevenson Island, with many of the latest events occurring near Fishing Bridge.

The recent swarm is well above typical activity at Yellowstone. Nevertheless it is not unprecedented during the last 40 years of monitoring. Swarms are the typical mode of occurrence of earthquakes within the Yellowstone caldera, with magnitudes ranging to > 4.0. The 1985 swarm on the northwest rim of the caldera lasted for three months, with earthquakes up to M4.9 and over 3000 total events recorded.

Magnitudes of earthquakes in this swarm range from zero to 3.9. Seismologists categorize those of magnitude less than 3.5 as generally not felt by persons. For perspective, earthquakes of magnitude 3.4 to 4.5 are often felt, as several of the events in this swarm have. A magnitude 5 or greater is generally required to produce damage to buildings or other structures.

Improved volcano and seismic monitoring at Yellowstone gives us a greater ability to locate earthquakes, understand their source process and identify anomalous sources of seismic activity. New equipment including precise measurements of ground motion by GPS receivers and borehole strainmeters provided by the National Science Foundation's EarthScope and Continental Dynamics Program have been used extensively during the last week of intense earthquake activity. Ground motions accompanying the swarm, from the GPS instruments will take two or more weeks to fully process. It is worth noting that in 2004 the Yellowstone caldera began a period of accelerated uplift measured by GPS instruments that was as large as 7 cm/yr (2.7 inches/yr), three times as fast as recorded in the recorded history but has now reduced to about a maximum rate of 4 cm/yr. Scientists have modeled this deformation as due to magmatic recharge of the Yellowstone magma chamber at a depth of ~10 km (6 miles). The area of the swarm is on the eastern side of the uplift area.

Earthquakes at Yellowstone are caused by a combination of geological factors including: 1) regional stress associated with normal faults (those where the valleys go down relative to the mountains) such as the nearby Teton and Hebgen Lake faults, 2) magmatic movements at depth (>7 kms or 4 miles), and 3) hydrothermal fluid activity caused as the groundwater system is heated to boiling by magmatic heat.

At this time, no one has noted any anomalous changes in surface discharges (hot springs, gas output, etc.).

YVO staff from the USGS, University of Utah and Yellowstone National Park continue to carefully review all data streams that are recorded in real-time. At this time, there is no reason to believe that magma has risen to a shallow level within the crust or that a volcanic eruption is likely. The USGS Volcano alert level for Yellowstone Volcano remains at Normal/Green.

Yellowstone National Park is evaluating infrastructure near the north end of Yellowstone Lake to assess if any damage has occurred to facilities.

Winter visitor activities and staff operations have not been impacted and continue as normal.

<http://volcanoes.usgs.gov/yvo/>

Other geologists are responding to these latest events by trying to be reassuring that this latest activity is most likely rather normal. Yet consider the comments from an interview by a researcher Bill Bryson with a noted Yellowstone volcano expert, Paul Doss. The interview suggests that we really do not know enough to be very reassured about any Yellowstone activity in regards to a volcanic eruption.

Here is a passage on the Yellowstone supervolcano from "A Short History of Nearly Everything" by Bill Bryson. He interviews a Yellowstone geologist, Paul Doss. I don't find it reassuring:

BB: I asked him what caused Yellowstone to blow when it did.

PD "Don't know. Nobody knows. Volcanoes are strange things. We really don't understand them at all. Vesuvius, in Italy, was active for three hundred years until an eruption in 1944 and then it just stopped. It's been silent ever since. Some volcanologists think that it is recharging in a big way, which is a little worrying because two million people live on or around it. But nobody knows."

BB "And how much warning would you get if Yellowstone was going to go?"

PD He shrugged. "Nobody was around the last time it blew, so nobody knows what the warning signs are. Probably you would have swarms of earthquakes and some surface uplift and possibly some changes in the patterns of behavior of the geysers and steam vents, but nobody really knows."

BB "So it could just blow without warning?"

PD He nodded thoughtfully. The trouble, he explained, is that nearly all the things that would constitute warning signs already exist in some measure at Yellowstone. "Earthquakes are generally a precursor of volcanic eruptions, but the park already has lots of earthquakes-1,260 of them last year. Most of them are too small to be felt, but they are earthquakes nonetheless."

A change in the pattern of geyser eruptions might also be taken as a clue, he said, but these too vary unpredictably. Once the most famous geyser in the park was Excelsior Geyser. It used to erupt regularly and spectacularly to heights of three hundred feet, but in 1888 it just stopped. Then in 1985 it erupted again, though only to a height of eighty feet. Steamboat Geyser is the biggest geyser in the world when it blows, shooting water four hundred feet into the air, but the intervals between its eruptions have ranged from as little as four days to almost fifty years. "If it blew today and again next week, that wouldn't tell us anything at all about what it might do the following week or the week after or twenty years

from now," Doss says. "The whole park is so volatile that it's essentially impossible to draw conclusions from almost anything that happens."

Evacuating Yellowstone would never be easy. The park gets some three million visitors a year, mostly in the three peak months of summer. The park's roads are comparatively few and they are kept intentionally narrow, partly to slow traffic, partly to preserve an air of picturesqueness, and partly because of topographical constraints. At the height of summer, it can easily take half a day to cross the park and hours to get anywhere within it. "Whenever people see animals, they just stop, wherever they are," Doss says. "We get bear jams. We get bison jams. We get wolf jams."

In the autumn of 2000, representatives from the U.S. Geological Survey and National Park Service, along with some academics, met and formed something called the Yellowstone Volcanic Observatory. Four such bodies were in existence already-in Hawaii, California, Alaska, and Washington-but oddly none in the largest volcanic zone in the world. The YVO is not actually a thing, but more an idea-an agreement to coordinate efforts at studying and analyzing the park's diverse geology. One of their first tasks, Doss told me, was to draw up an "earthquake and volcano hazards plan"-a plan of action in the event of a crisis.

"There isn't one already?" I said.

"No. Afraid not. But there will be soon."

"Isn't that just a little tardy?"

He smiled. "Well, let's just say that it's not any too soon."

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From the Honolulu Star-Bulletin

"An explosion matching the last Yellowstone eruption, which released 60 million times the energy of the Hiroshima bomb, would most certainly result in millions or even billions of deaths worldwide, both directly and indirectly.

One study predicts that half the U.S. could be covered in ash up to 3 feet deep. Earth could experience a "volcanic winter" with ash in the atmosphere keeping sunlight from reaching Earth's surface for several years.

The largest supervolcano eruption within the last 25 million years occurred at Lake Toba in Sumatra 73,000 years ago. The energy released was at least 15 percent greater than Yellowstone and 20,000 times greater than the largest human-made nuclear explosion. [LINK HERE](#).

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HERE ARE OTHER NEWS STORIES On the YELLOWSTONE SITUATION

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January 6 - New Scientist -- [LINK HERE](#)

January 6, Idaho Statesman -- [LINK HERE](#)

January 1 - Time Magazine -- [LINK HERE](#)

January 2, US News & World Report - [LINK HERE](#)

January 5, US News & World Report - [LINK HERE](#)

The Discovery Channel - Online Slide Presentation of Yellowstone -- [LINK](#)

USGS Quake Page for Yellowstone - (only quakes above 1.0) [LINK HERE](#)

USGS Yellowstone Animation Map of Recent Quakes -

Click start button to activate --- [LINK HERE](#)

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I am not quite sure what to make of this next linked page. I do not know who it is, but I do not think it is a geologist with the USGS or Yellowstone Nat'l Park, though it sure would appear to be an "official page" of some sort of government group. Yet it is not. [LINK HERE](#).

There will be more on this developing story and its prophetic implications in the near future.

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