Yellowstone 'supervolcano' could swiftly erupt, kill millions: Scientists solve riddle of 'Supervolcano' eruptions

Among the supervolcanoes on Earth are Lake Toba in Indonesia, above, Lake Taupo in New Zealand and the somewhat smaller Phlegraean Fields near Naples, Italy.

LOS ANGELES, CA (Catholic Online) - It was previously believed that an external trigger, such as an earthquake, would cause such an eruption. However, tests at the European Synchrotron Radiation Facility in Grenoble now prove that the sheer volume of liquid magma is enough to trigger a super-eruption.

Lead author Wim Malfait, of Zurich says that simulating the intense heat and pressure inside these "sleeping giants" could help predict a future disaster.

"We knew the clock was ticking but we didn't know how fast: what would it take to trigger a super-eruption? Now we know you don't need any extra factor - a supervolcano can erupt due to its enormous size alone. "Once you get enough melt, you can start an eruption just like that."

Among the supervolcanoes on Earth are Lake Toba in Indonesia, Lake Taupo in New Zealand and the somewhat smaller Phlegraean Fields near Naples, Italy.
Super-eruptions are very infrequent, occurring only once every 100,000 years on average. But when

they do occur - the world's climate is affected drastically.

When a supervolcano erupted 600,000 years ago in Wyoming, in what today is Yellowstone National Park, it ejected enough ash to bury a large city to a depth of a few kilometers. This ejection was 100 times bigger than Mt Pinatubo in the Philippines in 1992 and dwarfs even historic eruptions like Krakatoa in 1883.

"This is something that, as a species, we will eventually have to deal with. It will happen in future," Dr. Malfait says. "You could compare it to an asteroid impact - the risk at any given time is small, but when it happens the consequences will be catastrophic."

Being able to predict such a catastrophe is critical. The good news is if Yellowstone happened to be on the brink of an eruption, the good news is that we will still see a warning, Malfait told television reporters.

"The ground would probably rise hundreds of meters - a lot more than it does now. We think Yellowstone currently has 10-30 percent partial melt, and for the overpressure to be high enough to erupt would take about 50 percent."

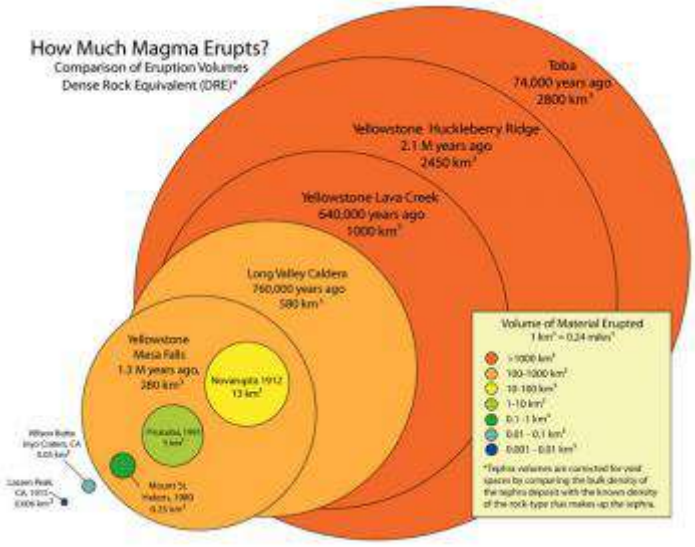
http://www.catholic.org/technology/story.php?id=53797

http://www.huffingtonpost.com/2014/01/07/supervolcano-spontaneous-eruption_n_4555317.html

http://volcanoes.usgs.gov/volcanoes/yellowstone/yellowstone_sub_page_49.html#supervolcano

Review the questions & answers about supervolcanoes below, then select the one favorite/ most interesting question & answer to write about in notebook & explain why it is interesting to you.

Questions About Supervolcanoes



What is a supervolcano?

Comparison of eruption sizes using the volume of magma erupted from several volcanoes.

The term "supervolcano" implies a volcanic center that has had an eruption of magnitude 8 on the Volcano Explosivity Index (VEI), meaning the measured deposits for that eruption is greater than 1,000 cubic kilometers (240 cubic miles). The VEI scale was created as a general measurement of the explosivity of an eruption. There are multiple characteristics used to give an eruption its VEI allowing for the classification of current and historic eruptions. The most common criteria are volume of ejecta (ash, pumice, lava) and column height. All VEI 8 eruptions occurred tens of thousands to millions of years ago making the volume of ejecta or deposits the best method for classification. An eruption is classified as a VEI 8 if the measured volume of deposits is greater than 1,000 cubic kilometers (240 cubic miles). Therefore a supervolcano is a volcano that at one point in time erupted more than 1,000 cubic kilometers of deposits. Yellowstone, like many other supervolcanoes, has also had much smaller eruptions. The cartoon shows a comparison of eruption sizes, including the three largest from Yellowstone. Click on the image for a more detailed description and larger view.

What are some other examples of supervolcanoes?

Volcanoes that produced exceedingly voluminous pyroclastic eruptions and formed large calderas in the past 2 million years would include Yellowstone, Long Valley in eastern California, Toba in Indonesia, and Taupo in New Zealand. Other "supervolcanoes" would likely include the large caldera volcanoes of Japan, Indonesia, and South America. The most recent supervolcanic eruption on Earth occurred 27,000 years ago at Taupo located at the center of New Zealand's north island.

I read that scientists couldn't find the Yellowstone caldera until they looked at a photo of Yellowstone from space. Is this true?

Not according to Bob Christiansen. Bob is the USGS scientist who delineated the three Yellowstone calderas and told the world about the great eruptions that formed them. Bob reports that he traced out the caldera boundaries through old fashioned field work... walking around with a hammer and hand lens and looking carefully at the rocks and their distributions. Most of the key observations were made in the 1960s and 1970s. Several authors have written that these large calderas were discovered from space and we suspect that the rumor probably got started because initial field work that delineated them was partly funded by NASA. The idea was to compare well-constrained geologic maps with images taken from space. So Bob's geologic map was used to verify the NASA images, not the other way around.

In 2005, BBC and the Discovery Channel produced a docudrama and documentary about Yellowstone called *Supervolcano*. Below, Yellowstone Volcano Observatory scientists answer questions that arose after this program aired that relate to supervolcanoes, volcanic hazards, and Yellowstone.

The docudrama Supervolcano dramatically explores the impact of a large caldera-forming eruption at Yellowstone. The scale of the portrayed eruption is similar to the eruption of the Huckleberry Ridge Tuff at Yellowstone 2.1 million years ago. The movie is realistic insofar as depicting what could happen if an eruption of this magnitude were to occur again. Although the

drama is set in the future, it does an acceptable job of addressing some of the issues scientists would grapple with if Yellowstone showed signs of an impending eruption. The questions and answers below shed light on issues related to volcanism at Yellowstone. A much more detailed discussion, including full-color illustrations, can be found in the U.S. Geological Survey Fact Sheet about Yellowstone's activity.

QUESTION: What is the chance of another catastrophic volcanic eruption at Yellowstone?

ANSWER: Although it is possible, scientists are not convinced that there will ever be another catastrophic eruption at Yellowstone. Given Yellowstone's past history, the yearly probability of another caldera-forming eruption could be calculated as 1 in 730,000 or 0.00014%. However, this number is based simply on averaging the two intervals between the three major past eruptions at Yellowstone — this is hardly enough to make a critical judgment. This probability is roughly similar to that of a large (1 kilometer) asteroid hitting the Earth. Moreover, catastrophic geologic events are neither regular nor predictable.

QUESTION: What is a "supervolcano"?

ANSWER: The term "supervolcano" implies an eruption of magnitude 8 on the Volcano Explosivity Index, meaning that more than 1,000 cubic kilometers (240 cubic miles) of magma (partially molten rock) are erupted. The most recent such event on Earth occurred 74,000 years ago at the Toba Caldera in Sumatra, Indonesia.

QUESTION: What would happen if a "supervolcano" eruption occurred again at Yellowstone?

ANSWER: Such a giant eruption would have regional effects such as falling ash and short-term (years to decades) changes to global climate. The surrounding states of Montana, Idaho, and Wyoming would be affected, as well as other places in the United States and the world. Such eruptions usually form calderas, broad volcanic depressions created as the ground surface collapses as a result of withdrawal of partially molten rock (magma) below. Fortunately, the chances of this sort of eruption at Yellowstone are exceedingly small in the next few thousands of years.

QUESTION: Is Yellowstone monitored for volcanic activity?

ANSWER: Yes. The Yellowstone Volcano Observatory (YVO), a partnership between the United States Geological Survey (USGS), Yellowstone National Park, and the University of Utah, closely monitors volcanic activity at Yellowstone. The YVO websitefeatures real- time data for earthquakes, ground deformation, stream flow, and selected stream temperatures. In addition, YVO scientists collaborate with scientists from around the world to study the Yellowstone volcano.

QUESTION: Do scientists know if a catastrophic eruption is currently imminent at Yellowstone?

ANSWER: There is no evidence that a catastrophic eruption at Yellowstone is imminent, and such events are unlikely to occur in the next few centuries. Scientists have also found no indication of an imminent smaller eruption of lava.

QUESTION: How far in advance could scientists predict an eruption of the Yellowstone volcano?

ANSWER: The science of forecasting a volcanic eruption has significantly advanced over the past 25 years. Most scientists think that the buildup preceding a catastrophic eruption would be detectable for weeks and perhaps months to years. Precursors to volcanic eruptions include strong earthquake swarms and rapid ground deformation and typically take place days to weeks before an actual eruption. Scientists at the Yellowstone Volcano Observatory (YVO) closely monitor the Yellowstone region for such precursors. They expect that the buildup to larger eruptions would include intense precursory activity (far exceeding background levels) at multiple spots within the Yellowstone volcano. As at many caldera systems around the world, small earthquakes, ground uplift and subsidence, and gas releases at Yellowstone are commonplace events and do not reflect impending eruptions.

QUESTION: Can you release some of the pressure at Yellowstone by drilling into the volcano?

ANSWER: No. Scientists agree that drilling into a volcano would be of questionable usefulness. Notwithstanding the enormous expense and technological difficulties in drilling through hot, mushy rock, drilling is unlikely to have much effect. At near magmatic temperatures and pressures, any hole would rapidly become sealed by minerals crystallizing from the natural fluids that are present at those depths.

QUESTION: Could the Yellowstone volcano have an eruption that is not catastrophic?

ANSWER: Yes. Over the past 640,000 years since the last giant eruption at Yellowstone, approximately 80 relatively nonexplosive eruptions have occurred and produced primarily lava flows. This would be the most likely kind of future eruption. If such an event were to occur today, there would be much disruption of activities in Yellowstone National Park, but in all likelihood few lives would be threatened. The most recent volcanic eruption at Yellowstone, a lava flow on the Pitchstone Plateau, occurred 70,000 years ago.

QUESTION: Because Yellowstone is so geologically active, are there other potential geologic hazards in Yellowstone?

ANSWER: The heat and geologic forces fueling the massive Yellowstone volcano affect the park in many ways. Yellowstone's many geysers, hotsprings, steam vents, and mudpots are evidence of the heat and geologic forces. These hydrothermal (hot water) features are mostly benign, but can rarely be the sites of violent steam explosions and pose a hydrothermal hazard. Earthquakes, another example of active geologic forces, are quite common in Yellowstone, with 1,000 to 3,000 occurring annually. Most of these are quite small, although significant earthquakes have shaken Yellowstone, such as the 1959 magnitude 7.5 Hebgen Lake quake, the largest historical earthquake in the intermountain region, and the 1975 magnitude 6.1

quake near Norris Geyser Basin. The many earthquakes and steam explosions in the past 10,000 years at Yellowstone have not led to volcanic eruptions.

http://volcanoes.usgs.gov/volcanoes/yellowstone/yellowstone_sub_page_49.html#supervolcano

There are several links on the 2nd article w/ more info, so I may create a webquest or something too…

http://www.bbc.co.uk/news/science-environment-25598050

Supervolcano eruption mystery solved

By James Morgan Science reporter, BBC News