

Yellowstone's Super Sisters - A List of Known Supervolcanoes

June 24, 2007

Where are there super volcanoes? There are other supervolcanoes on Earth, some of which erupted in prehistoric times and could erupt again. At least one has had an eruption bigger than Yellowstone's largest and may have played a critical role in shaping human history. The history – even the location – of others is less certain. Some are identifiable only by the deep layers of ash they left behind, such as the more than 1,000 cubic miles of tuff dumped in eastern Africa and the Red Sea by a mystery eruption somewhere in Ethiopia. There are also calderas that have just not been well studied, a prime example being Ethiopia's 460-square-mile Awasa caldera and the 1,000-square-mile Pastos Grandes caldera of Bolivia, which rivals the latter, which in turn rivals the largest in the world: Lake Toba, Indonesia.

Eruption from the Discovery Channel/BBC co-production Supervolcano. (Lake Toba, Sumatra, Indonesia)
LAKE TOBA, SUMATRA, INDONESIA SUPER VOLCANOThe 1,080-square-mile Toba caldera is the only supervolcano in existence that can be described as Yellowstone's "big" sister.

About 74,000 years ago, Toba erupted and ejected almost three times as much volcanic ash as the most recent major Yellowstone eruption (Lava Creek, 630,000 years ago) and about 12 percent more than Yellowstone's largest eruption (Huckleberry Ridge, 1.8 million years ago). That comes to several thousand times more material than erupted from Mount St. Helens in 1980.

Some researchers suspect that Toba's super eruption and the global cold spell it triggered might explain a mystery in the human genome. Our genes suggest we all come from a few thousand people just tens of thousands of years ago, instead of from a much older, bigger lineage – as the fossil evidence testifies. Both could be true if only a few small groups of humans survived the cold years following the Toba eruption.
LONG VALLEY, CALIFORNIA

Second only to Yellowstone in North America is the Long Valley caldera, in east-central California.

The 200-square-mile caldera is just south of Mono Lake, near the Nevada state line. The biggest eruption from Long Valley was 760,000 years ago, which unleashed 2,000 to 3,000 times as much lava and ash as Mount St. Helens, after which the caldera floor dropped about a mile, according to the U.S. Geological Survey.

Some of the ash reached as far east as Nebraska.

Long Valley's most recent eruption was in Mono Lake just 250 years ago, but it was very small. More worrisome is a swarm of strong earthquakes in 1980 and the 10-inch rise of about 100 square miles of caldera floor. Those developments have geologists concerned that Long Valley is gearing up for another eruption of some sort. In the early 1990s yet another subtle sign of trouble became evident: Large amounts of carbon dioxide gas from magma below had begun seeping up through the ground and killing trees in the Mammoth Mountain part of the caldera. When these sorts of signs are present at a "central vent" volcano like Mount St. Helens, trouble is on the way soon. At a caldera, which has many outlets, it could mean trouble is years, decades or even centuries away, say volcanologists.
LAKE TAUPO, NEW ZEALAND SUPER VOLCANONew Zealand's Taupo caldera has been filled by water, creating what many describe as one of the world's most beautiful landscapes. Lake Taupo itself was created by a massive eruption 26,500 years ago. The caldera – the collapsed and subsided basin left after the huge eruption – became today's lake. But Taupo did not die. The 485-square-mile caldera let loose again in the year A.D. 181, with estimates of ash and magma reaching as high as 22 cubic miles. That's on the order of a hundred times more than Mount St. Helens. Today Lake Taupo still shows signs of life, which New Zealanders have put to good use. Ample hot springs and other hydrothermal activity enable New Zealand to generate about 8 percent of its electricity at a geothermal plant on the north side of Lake Taupo, at Wairakei.

VALLES CALDERA, NEW MEXICO SUPER VOLCANO

There is a sleeping monster in the heart of New Mexico. The 175-square-mile Valles caldera forms a large pock in the middle of northern New Mexico, west of Santa Fe. It last exploded 1.2 million and 1.6 million years ago, piling up 150 cubic miles of rock and blasting ash as far away as Iowa. That's equivalent to roughly 2,000 Mount St. Helens eruptions.

Around the fractured ring of Valles caldera, lava flows from after the major eruptions built up mountains and left obsidian flows as recently as 60,000 years ago. As with other calderas, there are still signs of heat below: hot springs are still active around Valles.

Geologists suspect the cause of Valles caldera has something to do with how the western United States' portion of the North American tectonic plate is being pulled apart. Will Valles erupt again? No one knows. **AIRA, JAPAN SUPER VOLCANO** One of the most recently troubling calderas in the world is the 150-square-mile Aira caldera in southern Japan, on the edge of which sits the city of Kagoshima. After a century of peace, the Sakura-jima volcano, which forms part of the Aira caldera, awoke on Jan. 10, 1914, and gave local residents two days' notice of its intentions by letting loose hundreds of earthquakes. On Jan. 12, after 23,000 people and their farm animals living on its flanks were evacuated, Sakura-jima erupted with ash, steam and lava. It was not really a super eruption, but it taught people a lot about how volcanoes erupt. There was another eruption in 1946, and since 1955 Sakura-jima has had hundreds of small eruptions every year. The biggest eruptions, however, took place 22,000 years ago when 14 cubic miles of material burped out of the ground and formed the Aira caldera, which is now largely Kagoshima Bay. That is equal to about 50 Mount St. Helens eruptions. **SIBERIAN TRAPS** While a worst-case-scenario supervolcano eruption sometime in the future would be catastrophic for large parts of the world, that destruction would be minor compared with what scientists believe could be the largest lava flow in Earth's history: the Siberian Traps of 251 million years ago. The gigantic lava flow in Siberia lasted upward of a million years and flooded an area about the size of the lower 48 United States with layer upon layer of dark basalt lava "thousands of feet thick.

Some geologists suspect the eruption was caused by an extra-large plume of hot material welling up from the edge of the Earth's core. But what makes it especially important is that the Siberian Traps is the prime suspect in wiping out 90 percent of all living species 251 million years ago "the most severe extinction event in Earth's history.

"This is the numero uno candidate for a mass extinction caused by volcanism," said paleontologist Spencer Lucas, a curator at the New Mexico Museum of Natural History. "There's good reason to believe it had something to do with that extinction."

Not all scientists agree that the Siberian Traps were the main reason for the mass extinctions. But the timing of the Siberian eruption is perfect, for those looking for a culprit: It crosses a boundary in geologic time that marks the great die-off at the end of the Permian period and the beginning of the Triassic period (the P-T extinction).

And unlike the more famous dinosaur-killing Cretaceous-Tertiary mass extinction (aka the K-T extinction) 65 million years ago, the Permo-Triassic extinctions have not been linked to giant asteroids.

Since the Siberian flood basalts, as they are called, poured out during the time of the mass extinction, it's reasonable to think they might have played a role, said paleontologist Gerta Keller of Princeton University.

There are recent examples, after all, of the global impact of even relatively minor volcanic eruptions. The 1991 eruption of Mount Pinatubo in the Philippines, for example, sent millions of tons of sulfur dioxide into the atmosphere. One of the largest volcanic eruptions of the 20th century, it caused a recordable drop in global temperatures (a few tenths of a degree) for several years. And it was at least thousands of times smaller than the Siberian Traps eruption.

There is even reason to believe that an eruption of the largest super volcano in the recent history of the Earth "the Toba caldera on Sumatra, Indonesia " caused enough climate change to almost wipe out humanity 74,000 years ago.

As for exactly how the Siberian eruption could wipe out most life worldwide, it's probably not simply by burying the Earth in lava or ash, says Lucas. Instead, it was likely a complicated series of events, involving dust, volcanic gases and how they conspired to wreak havoc on the global climate "perhaps even causing the oceans to become oxygen deprived ("anoxic").

"I still think that right now greenhouse warming and anoxia is the strongest interpretation" for why most plant and animal species died across the globe, said Keller. **JUPITER'S IO** Because Earth's last supervolcano erupted more than 70,000 years ago, scientists studying the phenomenon rely largely on studying geological evidence of past eruptions, or monitoring seismic and other activity underground. But they do have another option: looking to Jupiter. More specifically, looking to Jupiter's moon, Io, the most volcanic place in the solar system. Chief volcano of Io's fiery fiefdom is a Connecticut-sized volcano called Loki. When scientists got a fresh look at Loki with the Galileo spacecraft on Thanksgiving Day 2002, they found a 125-mile-wide crater brimming with molten material, a lava expanse as wide as Lake Michigan. "That one volcano is putting out as much heat as the entire planet Earth," said planetary astronomer

John Spencer of the Southwest Research Institute. Galileo's imager also caught many other volcanoes, including another monstrous eruption whose heat overwhelmed the instrument's sensor. It was dubbed Tvashtar, with a mile-high curtain of 1,800-degree-F lava gushing out of a 15-mile fissure down its center. Volcanologists studying the science of "super eruptions" can learn a lot from Io, says Spencer. He explains that the ongoing eruptions on Io are somewhat like "super volcano" eruptions that have happened in Earth's past – like the 15 million-year-old Columbia River Flood Basalts in the Pacific Northwest, or the more recent (640,000-year-old) Yellowstone eruptions – only more extreme. The reason for Io's endless eruptions is simple: Jupiter and the other jovian satellites won't let it rest. Io orbits closest to Jupiter and feels the tug of the outer satellites as well. Their vying gravities are constantly kneading the moon-sized world with tidal forces, keeping its innards roiling and hot. "Humans have never witnessed Columbia River Basalts or Yellowstone eruptions," said Spencer. "Io has them frequently, so we can see them." A huge thanks to the Discovery Channel Online for permission to redistribute this information!

-=> Discuss this article on the Message Boards!

-=> Didn't find what you're looking for? Try Searching Armageddon Online!

-=> Spot a typo or have a general question? Use the Contact Forms to get your message out there!

^

^