

Natural Disasters

Lecture 21

Ch 7 – Volcano Case Histories: Killer Events

Text Source Today:

Chapter 7

7.1: Ch. 7 – Volcano Case Histories: Killer Events

● Killer Events and Processes:

volcanoes can **kill** in numerous ways, as they can burn you in a **pyroclastic flow**, slam and suffocate you with a **lahar**, batter and drown you with **tsunami**, poison you with **gas**, hit you with a **pyroclastic bomb**, fry you with a **lava flow**, and kill you with indirect events such as **famine**.

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TABLE 7.1
Volcanic Causes of Deaths

	275,000 Deaths	530 Volcanic Events
Pyroclastic flow	29%	15%
Tsunami	21%	5%
Lahar	15%	17%
Indirect (famine)	23%	5%
Gas	1%	4%
Lava flow	<1%	4%
Pyroclastic fall (bombs)	2%	21%
Debris avalanche	2%	3%
Flood	1%	2%
Earthquake	<1%	2%
Lightning	<1%	1%
Unknown	7%	20%

Data source: Simkin, T., Siebert, L., and Blong, R., "Volcano fatalities" in *Science* 291:255, 2001.

● **Volcano Prediction:** volcanologists can make long-term forecasts based on **past history** and **once activity begins**, can warn of an impending eruption, but at the current time, predicting a volcanic eruption in advance is **not possible**.

◆ **Volcano Mitigation:** a volcano may be active for **millions** of years, but **centuries** may pass between individual eruptions. The **time scale** of an active volcano must be considered by people living nearby.

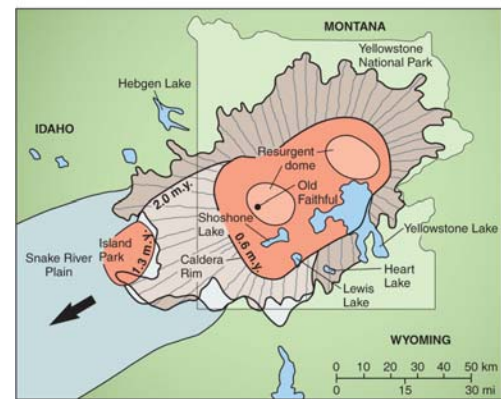
◆ **Signs of Impending Eruption:** (1) **seismic waves** are created as magma rises, causing rocks to snap and break, and as magma moves through conduits and fills the magma chamber; (2) **ground deformation** as the surface rises up and sinks down as magma moves up or withdraws; (3) **gas measurements of CO₂ and SO₂**, as both dissolved gases escape from magma nearing the surface; increasing **SO₂** → imminent eruption!

● **Lava flows** cannot be **stopped or redirected**, but short lead-time warnings for **lahars** and **pyroclastic flows** can be given.

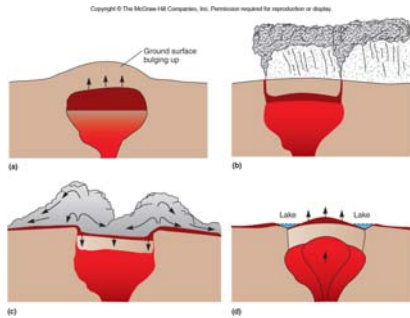
• Historic Volcanic Eruptions:

(Fig. 6.39)

♦♦ **Yellowstone, ~640,000 BCE, VEI=8:** a **giant resurgent caldera** (also called **supervolcano**), that is located above a continental **hot spot**. In the past 2 million years, Yellowstone has had three ultra-Plinian eruptions: 2 million years ago, 1.3 million years ago, and 0.64 million years ago. These eruptions were **catastrophic!**



(Fig. 6.40)



• **Caldera eruption sequence:** (a) rising mass of magma forms low-density cap rich in **SiO₂ and gases**, bulging the ground surface upward; (b) **Plinian** eruptions begin from circular fractures surrounding the bulge; (c) magma pours out in **pyroclastic flows** of tremendous volume, causing the ground to **sink into a giant caldera**; (d) removal of magma decreases the crustal pressure, causing new magma to bulge up the caldera floor over time, creating a **resurgent dome**.

♦♦ **Toba, ~72,000 BCE, VEI=8:** the “youngest” known resurgent caldera eruption, that was found by “volcano detectives”, who were surprised to find that **Lake Toba** in Indonesia was indeed a huge **caldera supervolcano!**

♦ The **Toba** eruption is accused of creating a “**volcanic winter**” and triggering **an ice age**. It is thought to have reduced the entire world human population to **10,000 or fewer** people, creating a bottleneck in human evolution.

♦♦ **Thera (Santorini), 1628 BCE, VEI=6:** perhaps the **largest eruption** on Earth in the past 2000 years and the most famous single event in the Aegean before the fall of Troy. This eruption is believed to be responsible for the dramatic collapse of the productive **Minoan** civilization on nearby **Crete**, and may have been responsible for the disappearance of the island empire of **“Atlantis,”** and may have been a natural force behind the **biblical plagues against Egypt during the Exodus**.

- **Thera** erupted in four phases: (1) a 6 m (20 ft) layer of air-settled **pumice** (an eruption above sea level); (2) several meter-thick deposits formed when rapidly flowing **hot water** scoured the area (caused when seawater reached the exposed magma chamber); (3) a 56 m (180 ft) thick **pyroclastic flow** (ash, pumice, large rocks) deposit, created by the **collapse of volcanic cones** in the center of Santorini, resulting in several **tsunami**; (4) layers of ash and small rock during the final de-gassing of the magma as it spit out ground-hugging hot gaseous clouds.

♦♦ **Vesuvius, 79 CE, VEI=6:** the detailed observations of this stratovolcano eruption by 17-year old **“Pliny the Younger”**, along with the well-preserved remains of **Pompeii and Herculaneum**, make this one of the most famous eruptions in history. This eruption killed over 10,000 people, many of whom refused to leave and were killed in the **pyroclastic flows**.

- **Plinian** eruptions create **“volcano weather”**, complete with heavy rain and ash (and lightning), which can set off a **volcanic mudflow** called a **lahar**.

♦ Today, **Vesuvius** is one of the **most dangerous volcanoes** on Earth because of the nearly **3 million people** living close to it in the Naples Bay area of Italy. **Vesuvius** last erupted in **1944**.

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- **DVD: “*Inside the Volcano*”, History Channel, 2008**

◆ **Question #1:** About how many volcanic eruptions are there around the world each year?

_____ **You must watch the video to get these answers!** _____

◆ **Question #2:** What is the only active volcano on continental Europe?

_____ **You must watch the video to get these answers!** _____

◆ **Question #3:** What is the ceremony that Neapolitans celebrate three times each year?

_____ **You must watch the video to get these answers!** _____
