



Volcanism

Part 2



Volcanic Materials: Solid

Ash and pyroclastic material (“the solid”) is airborne material ejected by a volcano:

- **Volcanic ash**

< 0.06 mm to 2 mm;
composed of rock, mineral,
and volcanic glass



- **Cinders**

2 mm to 64 mm;
composition same as ash
hazardous when falling!



- **Bombs**

> 64 mm, shapes vary;
formed by molten rock
solidifying in the air



Volcanic Materials: Gases



Significance?
Determines violence
of an eruption:

**High gas = violent
eruptions!**

- **Volatiles:**

H_2S – Hydrogen sulfide

H_2O – Water vapor

SO_2 – Sulfides

CO_2 – Carbon dioxide

N_2 – Nitrogen

HCl – Hydrochloric Acid

Effect on global climate

← block sunlight

← greenhouse gas

Volcanic Landforms: Cones

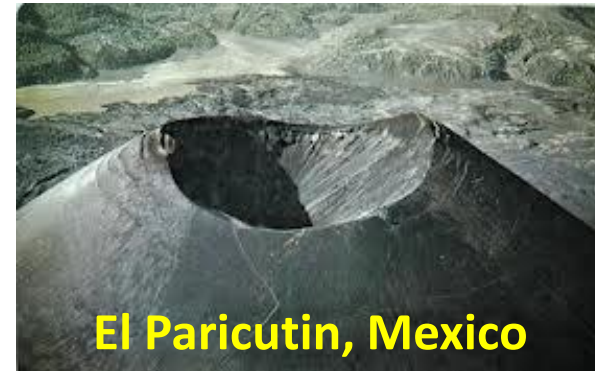
- **Shield volcanoes**

- Multiple layers of basaltic lava
- Shallow sides due to magma's low viscosity
- "Gentle" eruptions



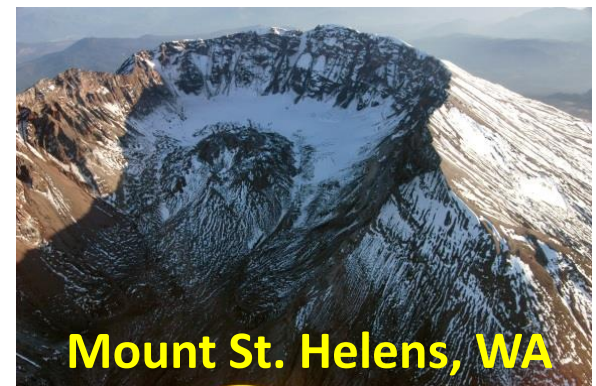
- **Cinder cones**

- Layered ash and cinders
- Smallest volcanic cone
- Short, narrow cone, steep sides
- Violent eruptions



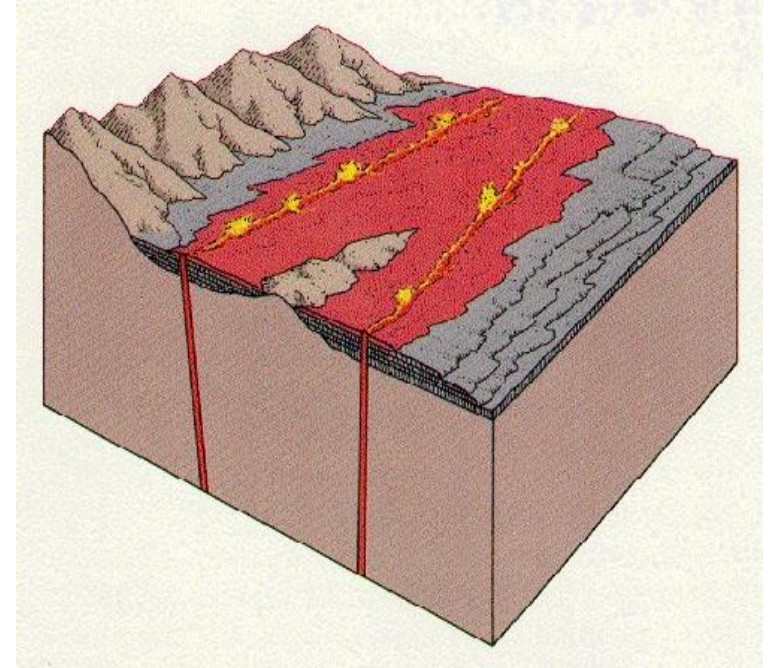
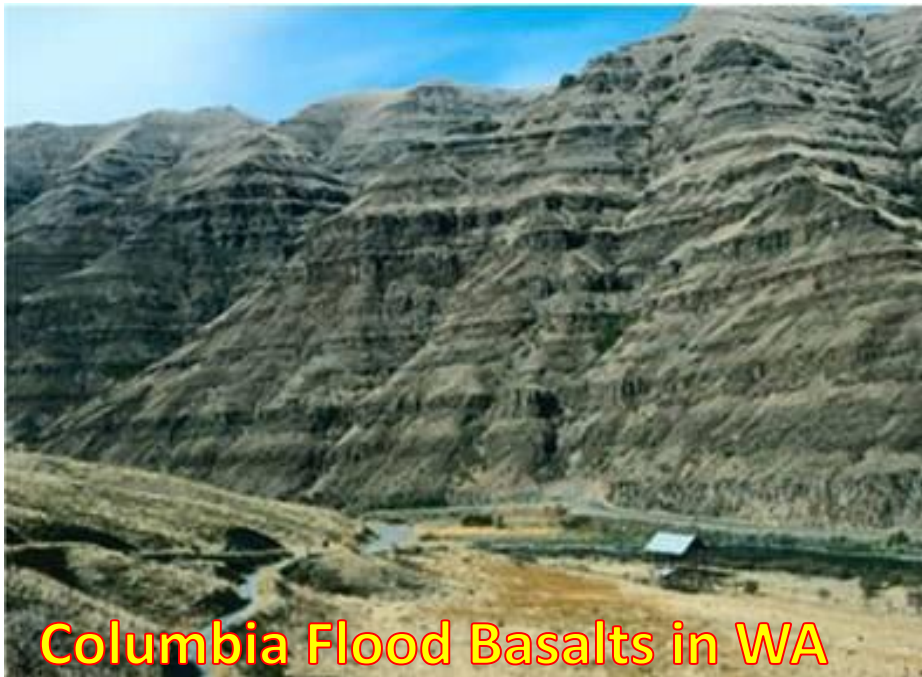
- **Composite cones (stratovolcanoes)**

- Layered ash, lava, and mud
- Steep sides due to magma's high viscosity
- Tall volcanoes – 1 to 2 miles high
- Violent eruptions



Volcanic Landforms: Flood Basalts

- Large (10-100 square miles) outpourings of very low viscosity basaltic lava
- Multiple, “quiet” eruptions
- Lava plateau forms



Flood basalt volcanism
has been connected to
major mass extinction
events in the past.

Volcanic Landforms: Calderas

Volcano rapidly empties its magma chamber, and support is lost. Overlying material collapses into magma chamber: a caldera forms.

- **Explosive calderas**

Silica-rich magma feeding these volcanoes has high viscosity; gases tend to become trapped at high pressure within the magma, resulting in explosion.



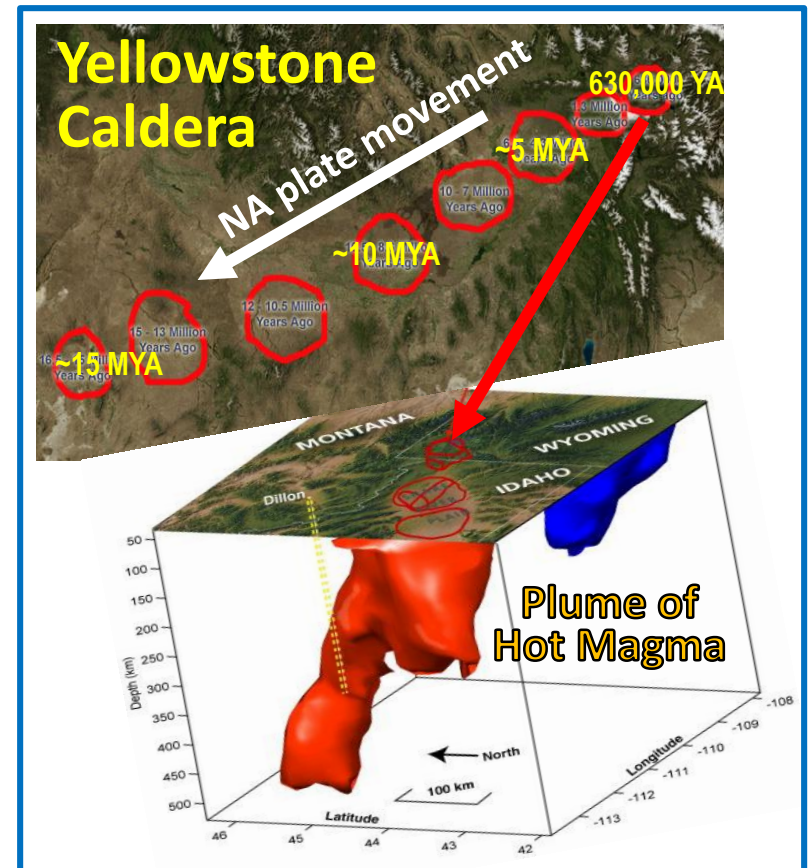
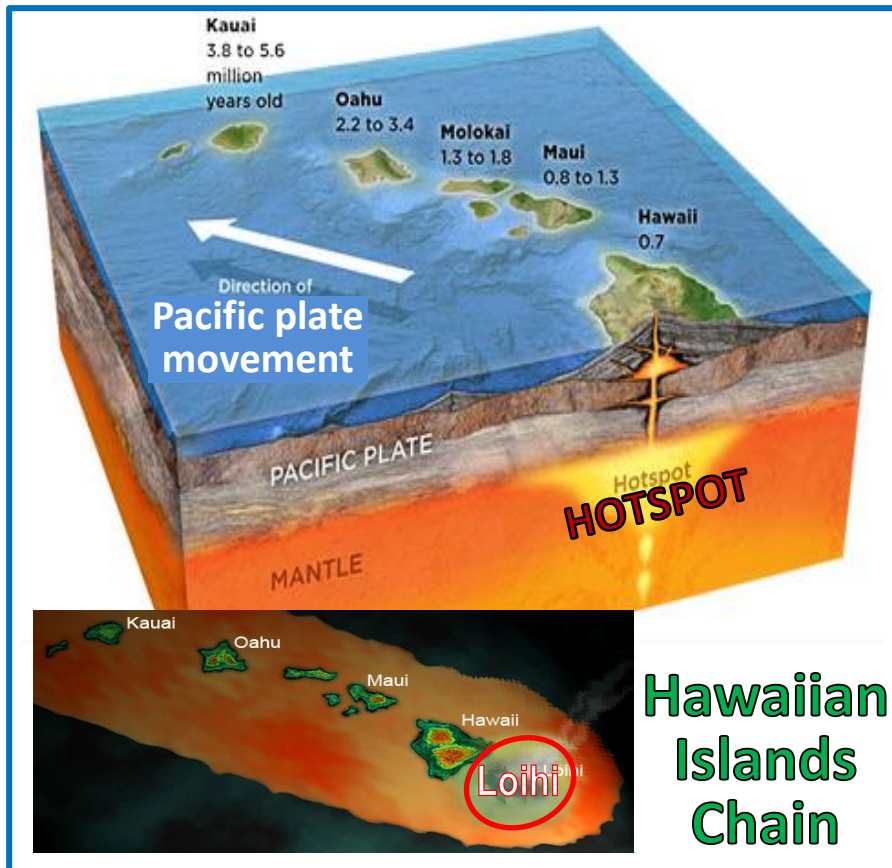
- **Non-explosive calderas**

Basaltic magma feeding these volcanoes is silica poor and much less viscous; the magma chamber is drained by large lava flows rather than by explosive events.



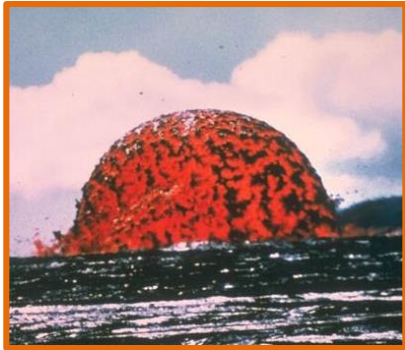
Hot Spot Volcanism

Hot spots are due to a **plume of hot magma** flowing up to the crust from the core-mantle boundary. This plume is for some reason sustained over long geologic periods. Over time, the tectonic plates of the Earth move over these hot spots leaving a **trail of volcanoes**.



Notable Volcanoes

- **Mt. Etna, Italy**
Continuous eruption for almost 110 years!



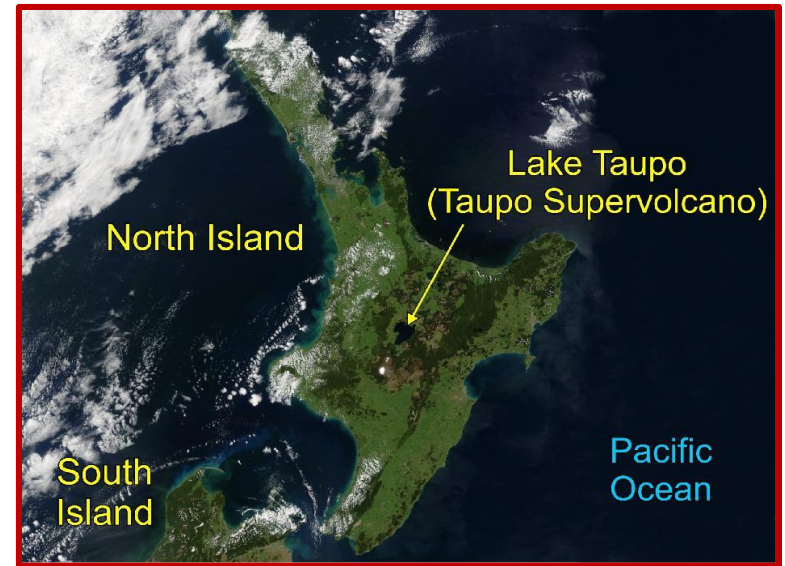
- **Kilauea, Hawaii**
Largest observed lava lake



Notable Volcanoes

- **Taupo, New Zealand**

Largest known supervolcano eruption in the past 50,000 years.



- **Krakatoa, Indonesia**

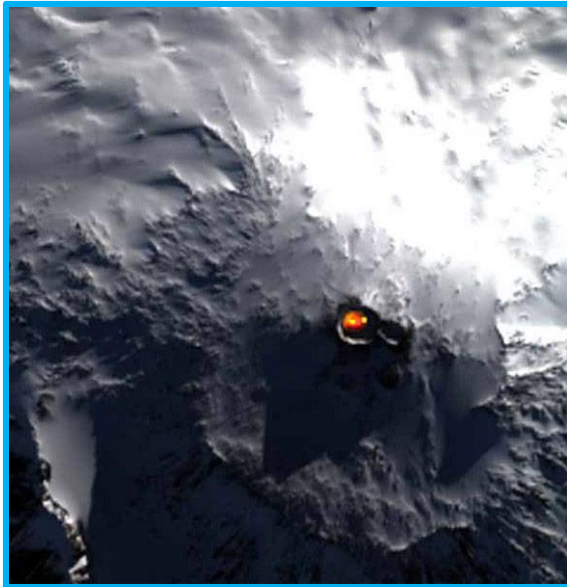
1883 explosive eruption produced huge (40 meters!) tsunamis as well as loudest sound ever heard in modern history.

NOW ←

THEN →



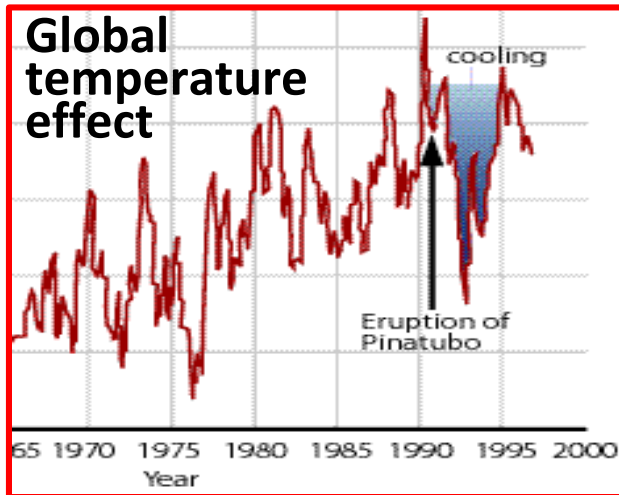
Notable Volcanoes



- **Mt. Erebus, Antarctica**
Southernmost active volcano on Earth.



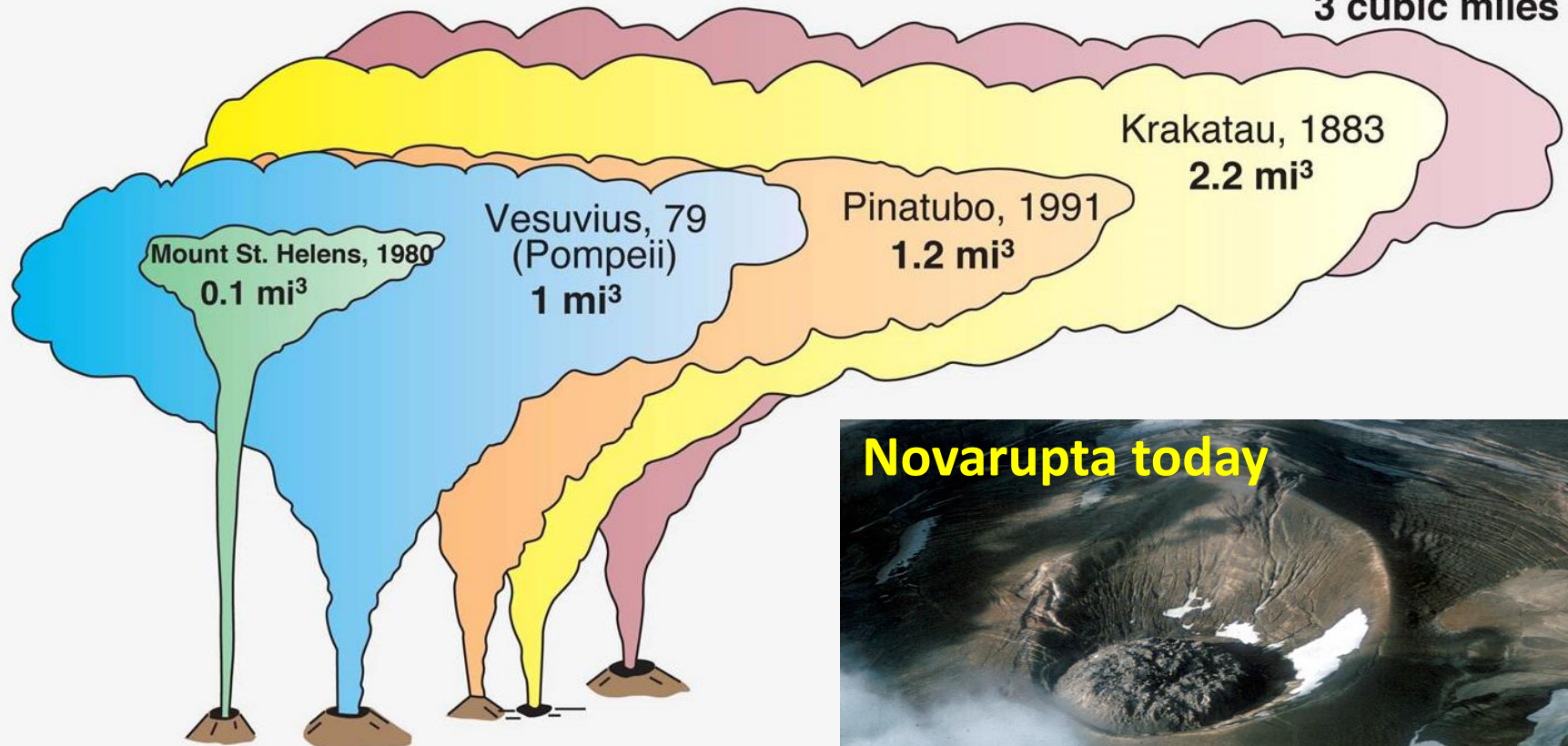
- **Mt. Pinatubo, Philippines**
Second largest eruption of the 20th century, June 1991.



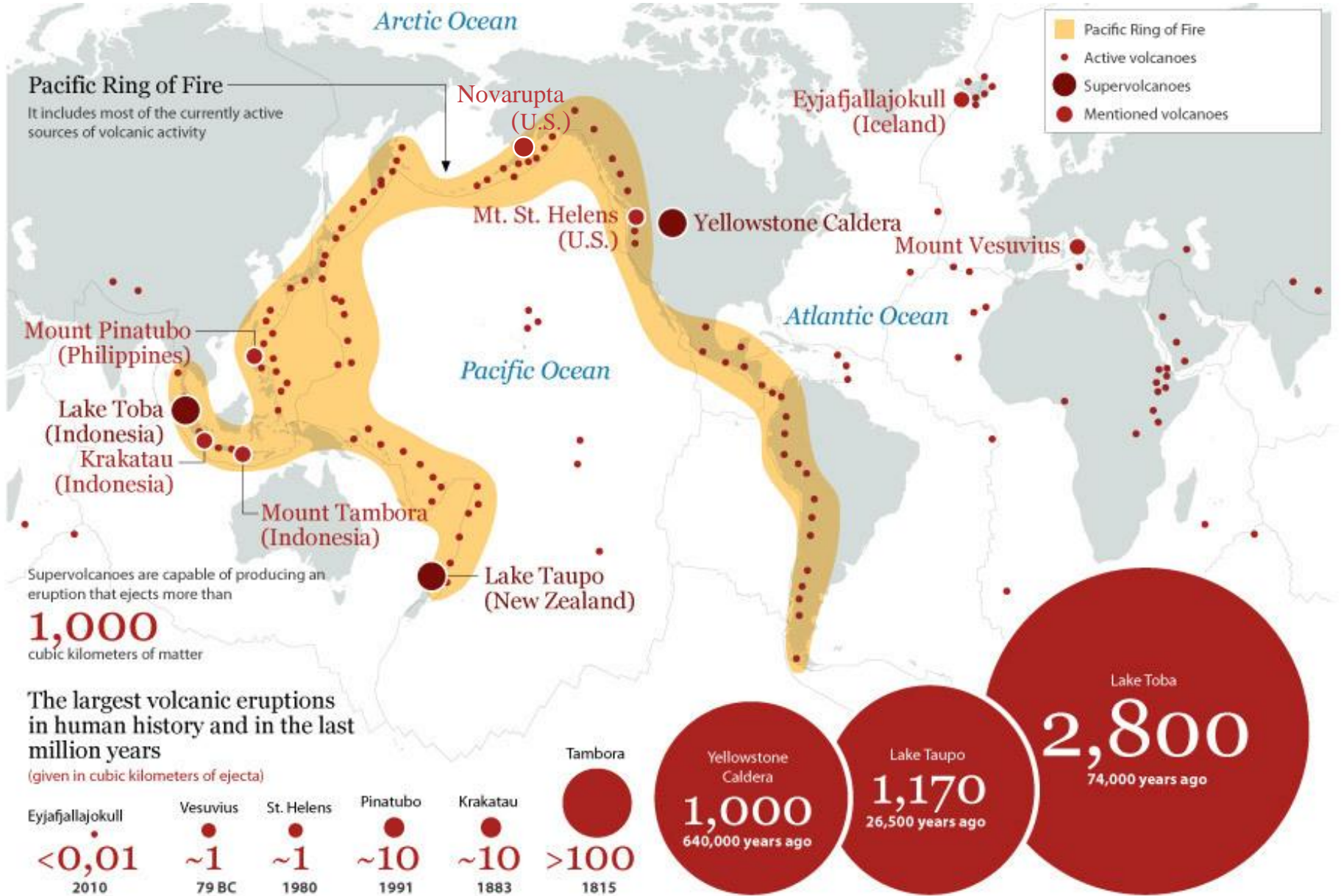
The Most Powerful Volcanic Eruption of the 20th Century

People in Juneau, Alaska, about 750 miles from the volcano, heard the sound of the blast – *over one hour after* it occurred.

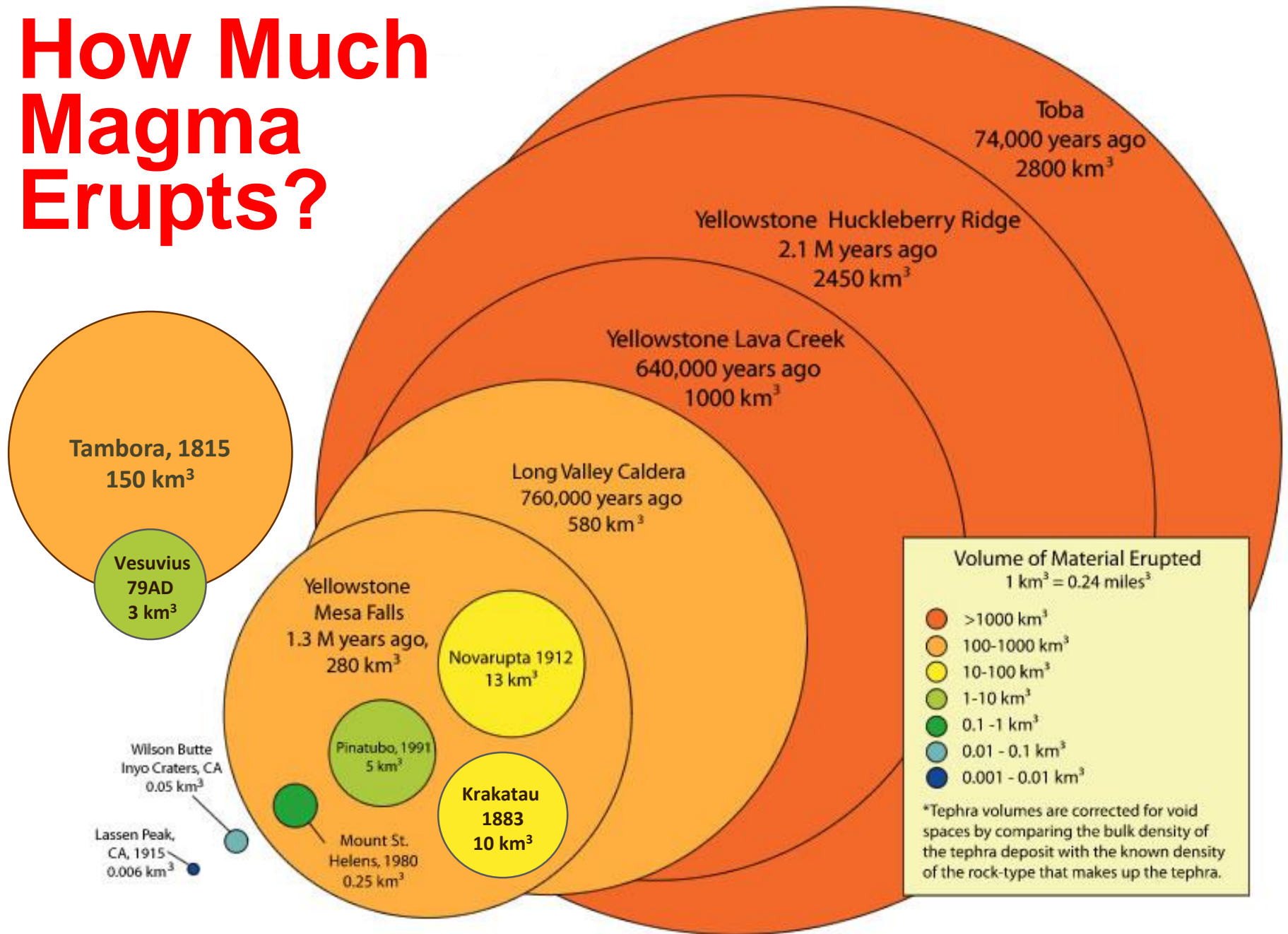
• **NOVARUPTA**
Alaska 1912
3 cubic miles



Greatest Historic Eruptions



How Much Magma Erupts?



How do volcanologists predict eruptions?

- **Measuring small quakes**
 - increase in number & intensity before eruption.
- **Measuring slope**
 - bulges may form with magma pushing up.
- **Measuring volcanic gases**
 - outflow of volcanic gases (*sulfur dioxide, carbon dioxide*) may precede eruption.
- **Measuring temperature from orbit**
 - monitoring changes in temperature over time.

Selected Videos

Eruption of Mt Etna, Sicily, Italy

<https://www.youtube.com/watch?v=cogEmEyg95Q>

Anak Krakatau eruption

<https://www.youtube.com/watch?v=JmPuy-pqIQE>