

Holy Smokes!

A Volcano Primer

By Mrs. Baker



What is a volcano?



- A **volcano** is an opening in Earth that erupts gases, ash, and lava.
- Volcanic mountains form when layers of lava, ash, and other material build up around these openings.

3 Basic Volcano shapes

- Shape

- tells us **1. Cinder Cone**

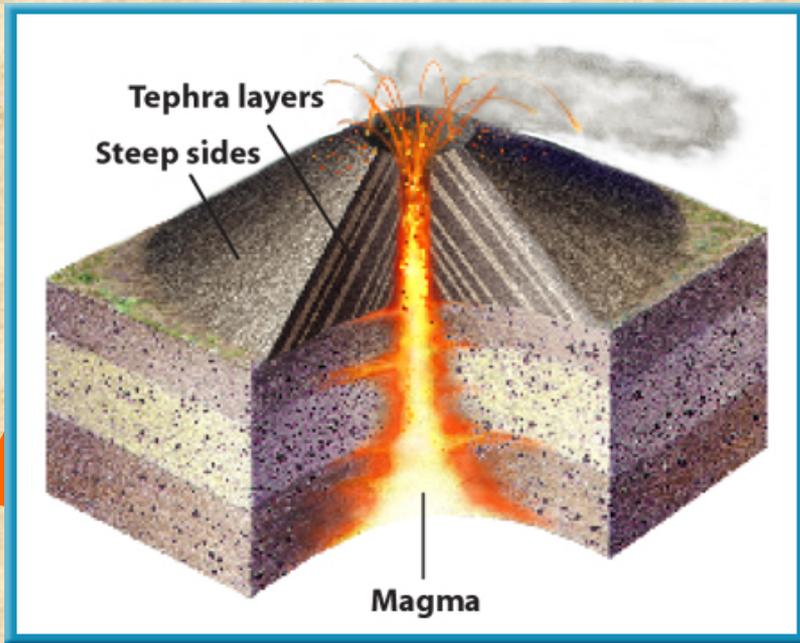
something about how the volcano was formed.

- 2. Shield**

- 3. Composite Cone**



1. Cinder Cone Volcano



- Formed by Tephra (volcanic cinders, bit of solidified lava, and bits of rocks) thrown into the air during an eruption & then fall back down around the vent (volcanic opening) forming a steep-sided loosely packed volcano.



Example

Cinder Cone Volcano



- Parícutin Volcano in Mexico is a great example of a cinder cone volcano.



Paracútin

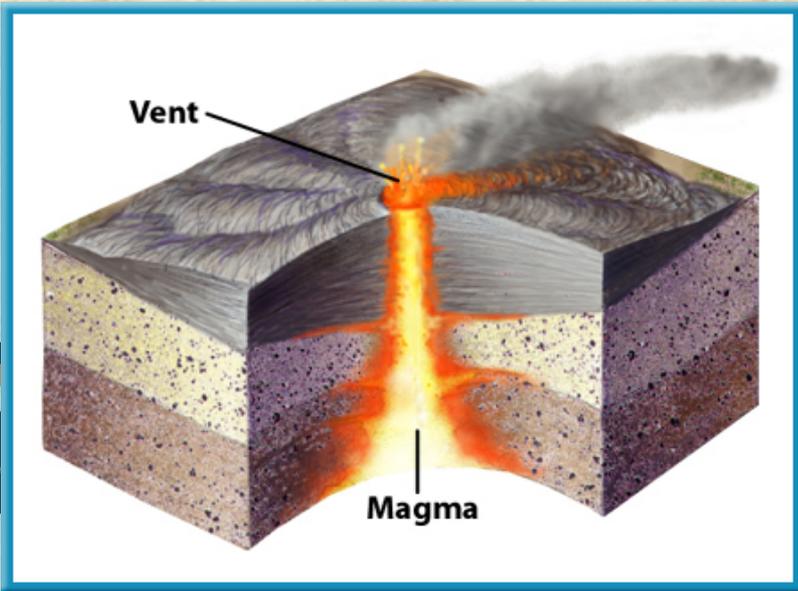


- On February 20, 1943, a Mexican farmer noticed that a hole in his cornfield that had been there for as long as he could remember was giving off smoke.
- Throughout the night, hot glowing cinders were thrown high into the air.
- In just a few days, a cinder cone several hundred meters high covered his cornfield.



2. Shield Volcano

- Quiet eruptions of basaltic lava spread out in flat layers.
- The buildup of these layers forms a broad volcano with gently sloping sides.



Shield Volcano

- The shapes of these volcanoes reflect the fact that they are constructed of lava flows that erupted non-explosively.
- It is usually many times larger than a composite cone or cinder cone volcano.



Mauna Kea volcano

picture from www.usgs.gov



Example of Shield Volcano



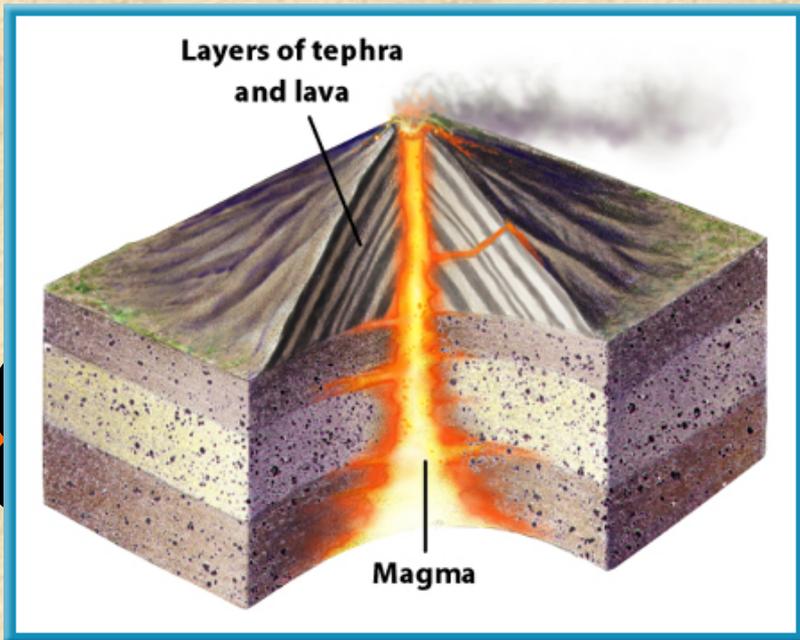
Mt. Kilauea

Picture from <http://www.britannica.com/eb/art-89176/Hawaiiis-Kilauea-is-an-active-volcano>

- Mauna Loa
- Mt. Kilauea
 - Probably one of the world's most active volcanoes.
 - The eruption of Kilauea Volcano that began in 1983 continues at the cinder-and-spatter cone of Pu`u `O`o

3. Composite Volcano

- This type of volcano is composed of explosively erupted pyroclastic materials layered with lava flows and volcanic debris.



- An explosive period can release gas and ash, forming a tephra layer.
- Then, the eruption can switch to a quieter period, erupting lava over the top of the tephra layer.

Example of Composite Volcano



The same view shows the profound change in the volcano and Spirit Lake. The formerly clear mountain lake had been completely displaced by the massive landslide and choked with ash and organic debris.
[J.Franklin, USDA Forest Service, 1980]

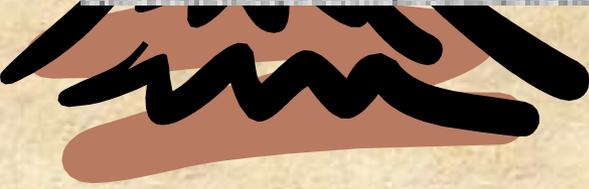


- Mount St. Helen's
 - Erupted in 1980
 - 57 fatalities
 - Over 7000 big game animals perished
 - 4 billion board feet of timber (enough to build about 300,000 two-bedroom homes) destroyed
 - Destroyed 27 bridges, nearly 200 homes. Blast and lahars destroyed more than 185 miles of highways and roads and 15 miles of railways.

Example of Composite Volcano

- Mount Pinatubo

- Erupted in 1991
- Killed 847 people
- 184 people injured
- 10,000 home destroyed and another 5,000 were damaged.
- The ash cloud took one year to spread around the globe, reducing global temperatures. This resulted in
 - ◆ Floods in 1993 along the Mississippi River
 - ◆ Drought in Africa in 1993
 - ◆ The US had its 3rd wettest & coldest winter on record.



Example of Composite Volcano

Anak Krakatau,
"Child of Krakatau,"
formed in the early
1900s.



● Krakatau

- One of the most violent eruptions in recent times occurred on an island in the Sunda Straits near Indonesia in August of 1883.
- Krakatau, a volcano on the island, erupted with such force that the island disappeared.



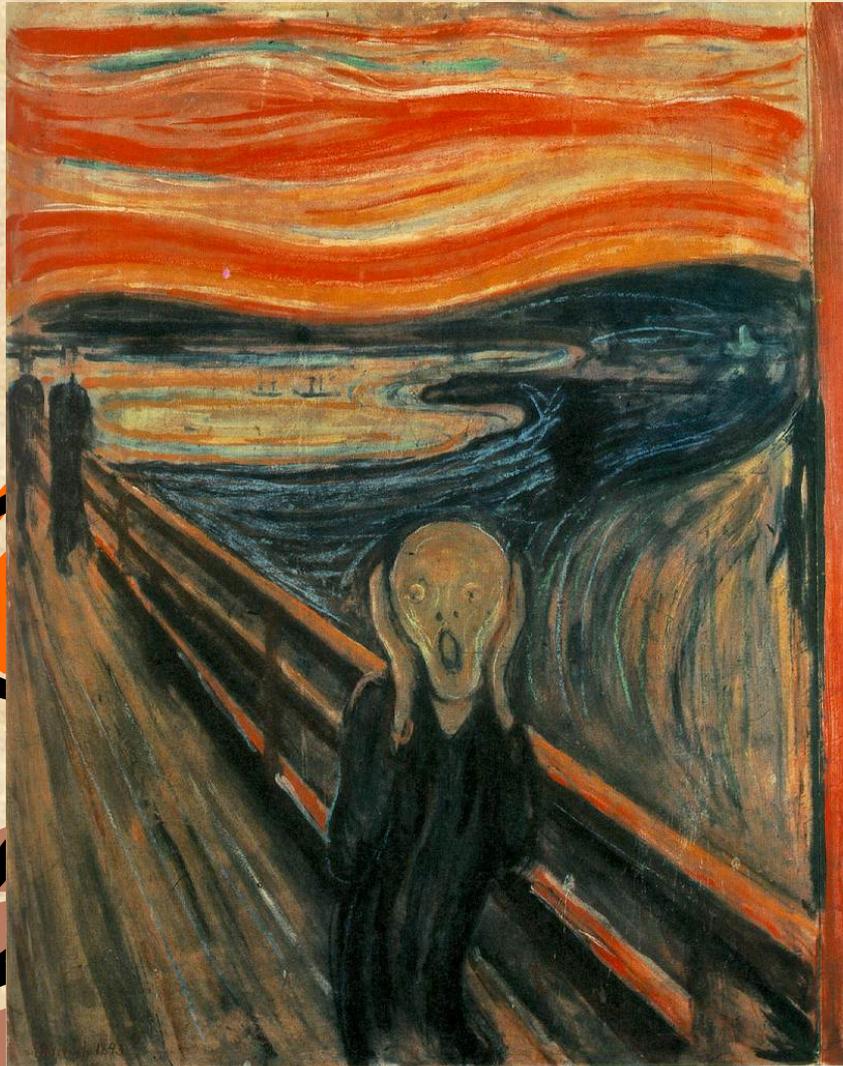
Example of Composite Volcano

Krakatau



- Killed 36,000 people most were killed by a giant tsunami
- Destroyed 160 villages
- Fine ashes from the eruption were carried by upper level winds as far away as New York City
- Volcanic dust lowered global temperatures for five years, this caused

Example of Composite Volcano Krakatau



- Unusual sunsets and weather patterns for three years
- Evidence:
 - ◆ William Ashcroft's paintings
 - ◆ The Scream

What determines how explosive an eruption is?



- Amount of trapped gases
- Amount of Water Vapor
- Composition of Magma



1. Trapped Gases

- Gases such as water vapor and carbon dioxide are trapped in magma by the pressure of the surrounding magma and rock.



- Gas escapes easily from some magma during quiet eruptions.

- However, gas that builds up to high pressures eventually causes explosive eruptions.



2. Amount of Water Vapor



- The magma at some convergent plate boundaries contains a lot of water vapor.
- This is because oceanic plate material and some of its water slide under other plate material at some convergent plate boundaries.
- The trapped water vapor in the magma can cause explosive eruptions.

3. Magma Composition



- The composition (what it is made of) determines how explosive a volcano will be.



Magma Composition

Basaltic



- Magma made of basalt is very fluid, allowing trapped gases to escape easily.
- Volcanoes with basaltic lava have quiet, non-explosive eruptions.



Magma Composition

Basaltic

• If the same lava flows at a lower temperature, it cools more slowly and forms a different lava formation.

- Volcanoes with basaltic lava produce:



Magma Composition

Basaltic

Examples

- You can find volcanoes with basaltic lava

- Hawaiian Volcanoes, including

- ◆ Kilauea
- ◆ Mona Loa

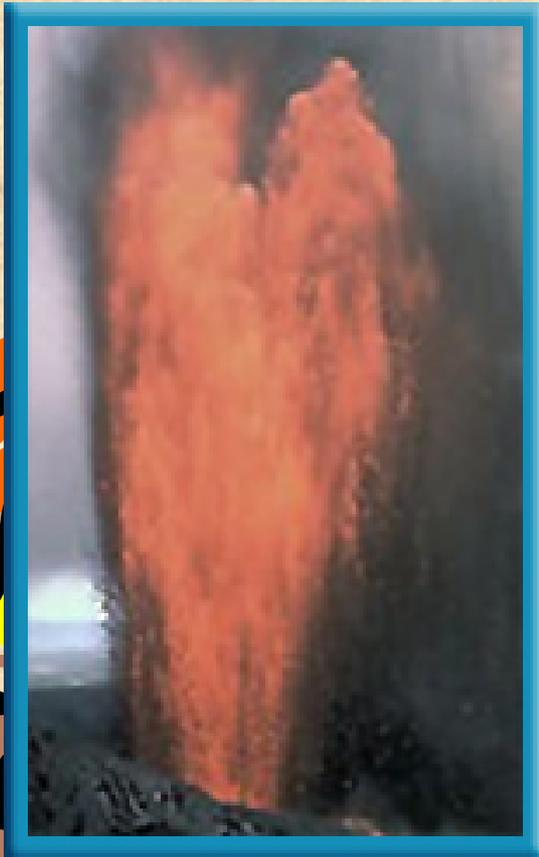
- Iceland

- ◆ Heimaey
- ◆ Hekla



Magma Composition

Granitic Lava



- Silica-rich, or granitic (also called rhyolite) magma produces explosive eruptions.
- Silica-rich granitic magma is thick, and gas gets trapped inside, causing pressure to build up.

Magma Composition

Granitic Lava

"If it had erupted in a populated area..." The magnitude of the eruption can perhaps be best realized if one could imagine a similar outburst centered in New York City. All of Greater New York would be buried under from ten to fifteen feet of ash; Philadelphia would be covered by a foot of gray ash and would be in total darkness for sixty hours; Washington and Buffalo would receive a quarter of an inch of ash, with a short period of darkness. The sound of the explosion would be heard in Atlanta and St. Louis, and the fumes noticed as far away as Denver, San Antonio, and Jamaica."

● Some examples of granitic volcanoes are

- Yellowstone Caldera
 - ◆ It is a super volcano!
- Katmai, Alaska
 - ◆ Last erupted in 1912.



Magma Composition

Andesitic Lava



Cotopaxi, Ecuador

Charles A. Wood

- Volcanoes with andesitic magmas have violent, explosive eruptions.
- It often forms at convergent plate boundaries where one plate slides under the other.



Magma Composition

Andesitic Lava



- The word *andesitic* comes from the Andes, which are mountains located along the western edge of South America, where andesite rock is common.
- Many of the volcanoes encircling the Pacific Ocean also are made of andesite.

Magma Composition

Andesitic Lava

Mount Pelee, Martinique

- Famous for the May 8, 1902 eruption which killed 29,000 people and destroyed the city of St. Pierre. This is the largest number of causalities for a volcanic eruption this century.

● Mayon, Phillipines

- It is the most active volcano in the Philippines. Since 1616, Mayon has erupted 47 times.
- It's 1814 eruption killed 1,600.



Volcanoes in a nutshell

● Three volcano types

■ Shape

- ◆ Cinder
 - ◆ Violent eruptions
- ◆ Composite
 - ◆ Violent & quiet eruptions
- ◆ Shield
 - ◆ Quiet Eruptions



Volcanoes in a nutshell

- Three factors affect how violent an eruption will be
 - Water Vapor
 - ◆ More water vapor = bigger explosion
 - Trapped Gasses
 - ◆ How easily the gas escapes determines how violent the explosion
 - ◆ Easy escape = quiet eruption
 - ◆ Difficult to escape = explosive eruption
 - Magma Type
 - ◆ Basaltic Magma = quiet explosion
 - ◆ Granitic/Andesitic = violent eruptions



Resources used

- Volcano World
■ <http://volcano.und.edu/>
- US Geologic Survey
■ <http://www.usgs.gov/>
- Glencoe Earth Materials & Processes

