Today:

1) Volcanic Processes at Earth's Surface (Extrusive)

Next Meeting:

1) Wrap-up Volcanoes/Igneous Rocks
2) Pompeii Movie (58 min)

Chiatin Volcanic Eruption (2008), Chile

Volcanic Processes at the Surface

Extrusive Igneous Rocks

All Volcanoes are not alike

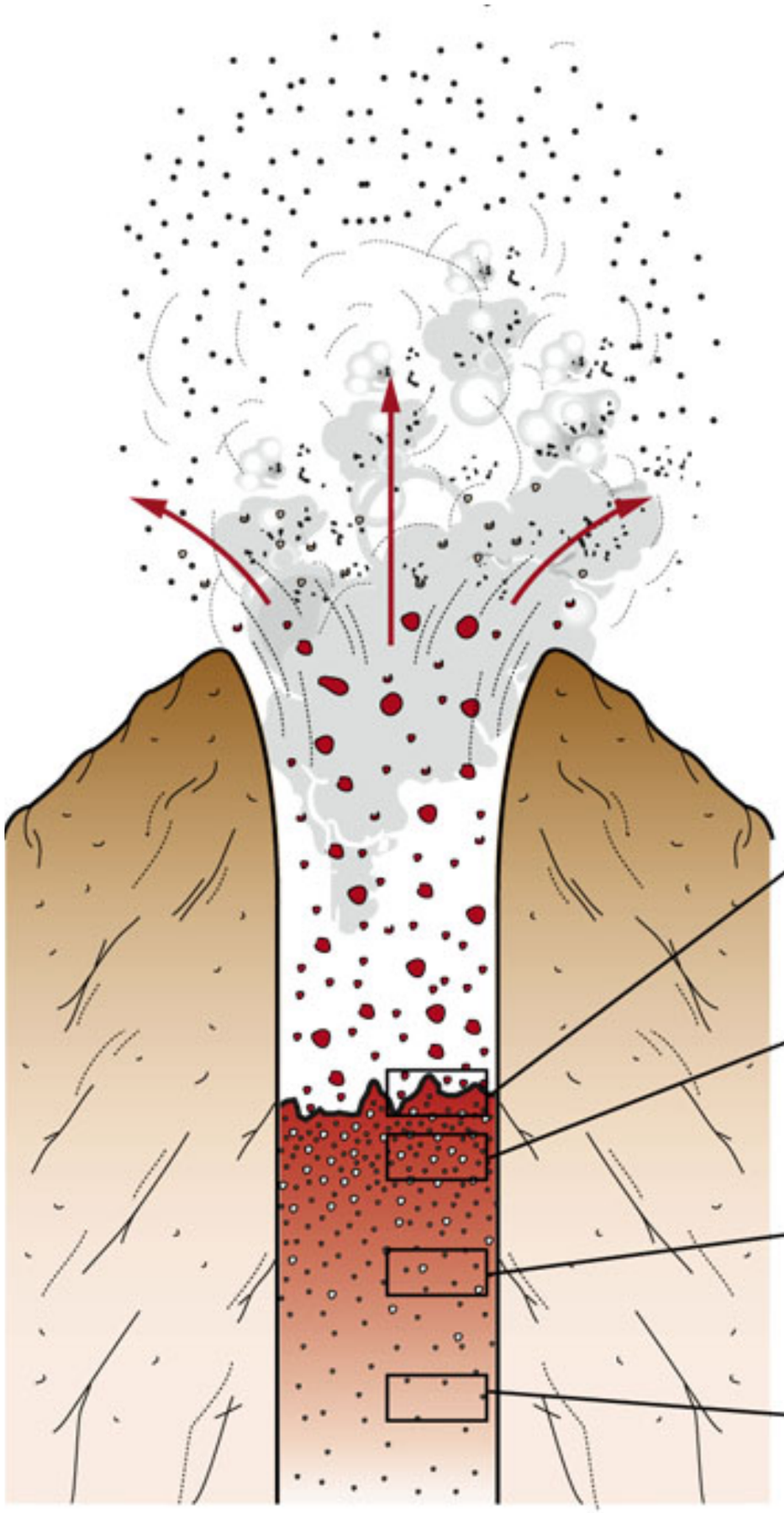
Mt. Fuji, Japan

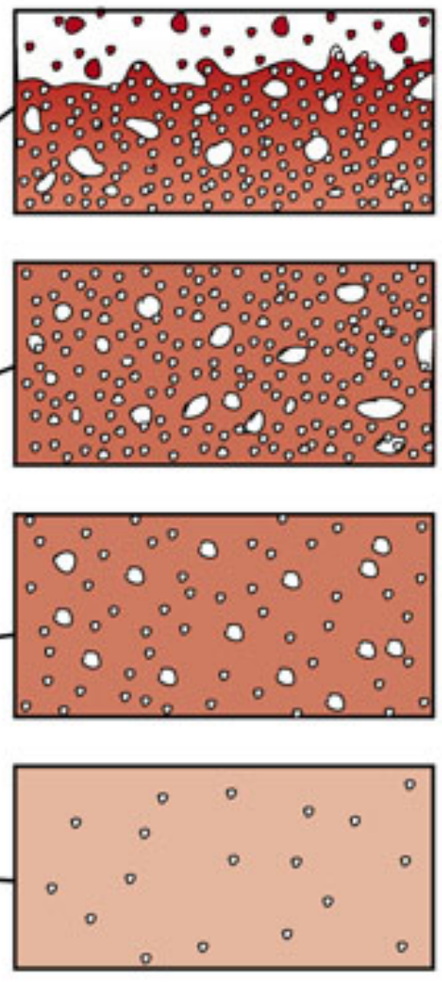
Mauna Loa, HI

Michoacan, Mexico

Extrusive Volcanic Rocks

The Role of Volatiles and Bubbles in a Volcanic Eruption





D) Bubbles begin to become inter connected, forcing magma apart

C) Magma froth

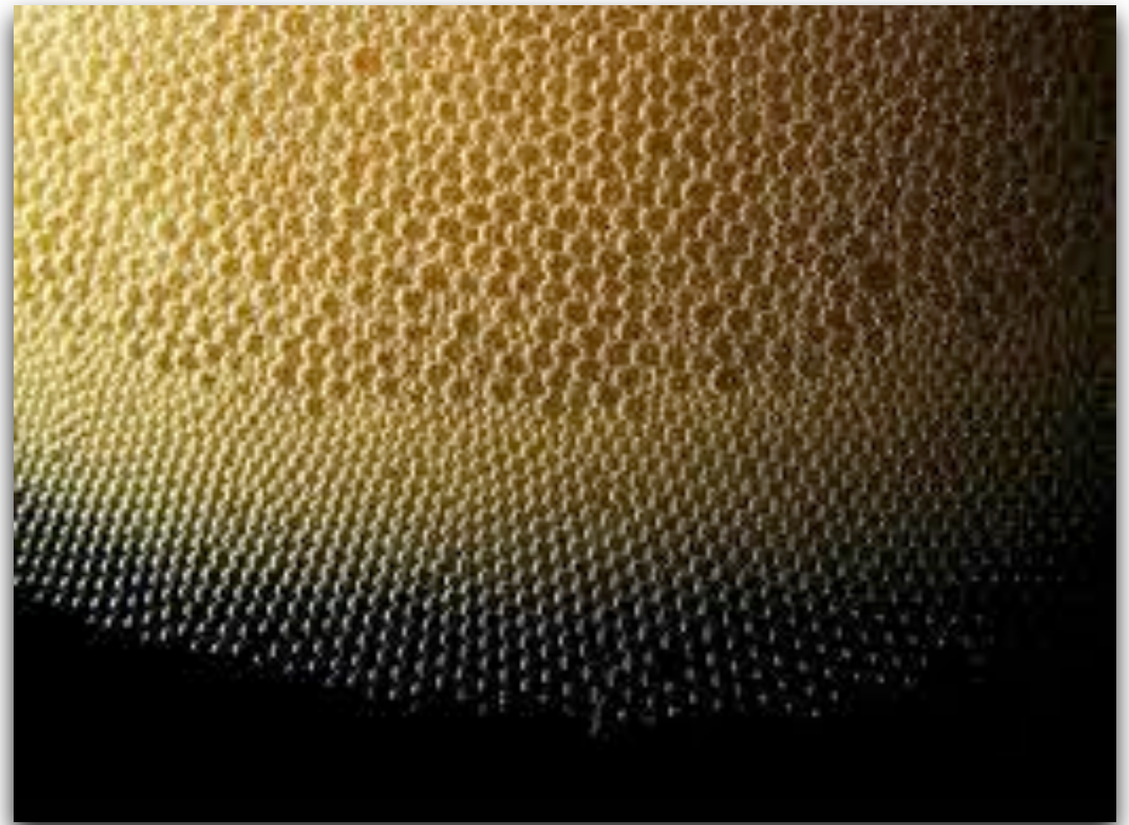
B) Bubbles grow

A) Steam separates out as bubbles

The Role of Volatiles and Bubbles in a Volcanic Eruption

The Role of Volatiles and Bubbles in a Volcanic Eruption

Bubbles in Honey



Bubbles in Coke

Pyroclastic Material or Tephra

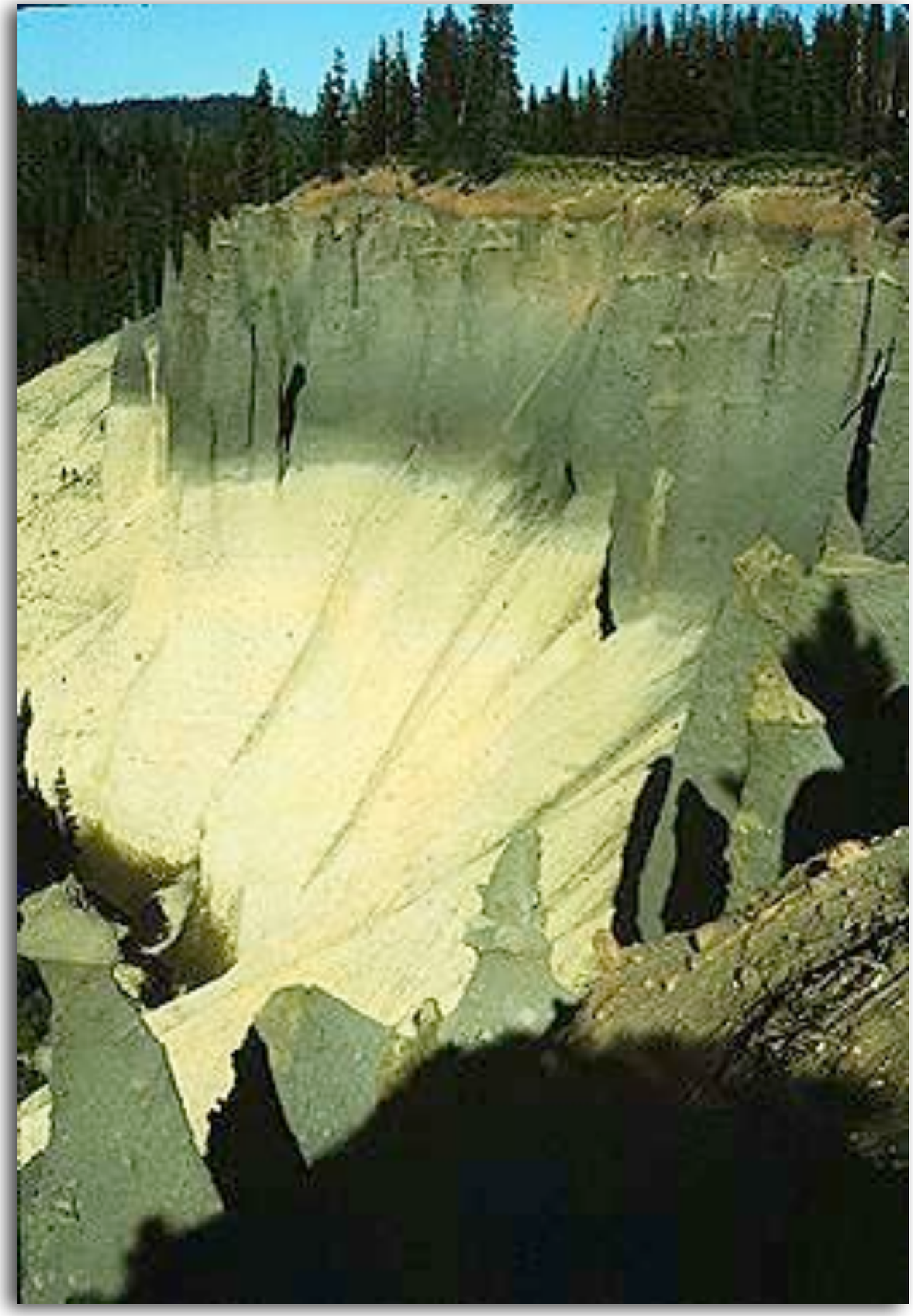
Andesitic Eruption

Basaltic Eruption

Ash

Cinders

Bombs



Layered Air Fall Tuff

Tuff- The rock name given to a deposit composed of pyroclastic material. May be composed of ash, cinders, and bombs or all of the above.

Crater Lake Area, OR

Effusive Deposits

Lava Flows- May be composed of Basaltic, Andesitic or Rhyolitic

Why different magma's behave differently and make different volcanoes.

The 3 V's of Volcanoes

Viscosity - The resistance of a material to flow.
"Stickiness"

Volatiles - Elements or compounds such as H2O, CO2, and SO2 that evaporate easily and can exist as a gas at the Earths surface. The most important affect of Volatiles on magma is the formation of bubbles.

Volume - How much material is erupted.

5 Types of Volcanoes

1) Stratovolcano

2) Shield Volcano

3) Scoria / Cinder Cone

4) Continental Caldera

5) Flood Basalt

6) Lava Dome

5 Types of Volcanoes

1) Stratovolcano

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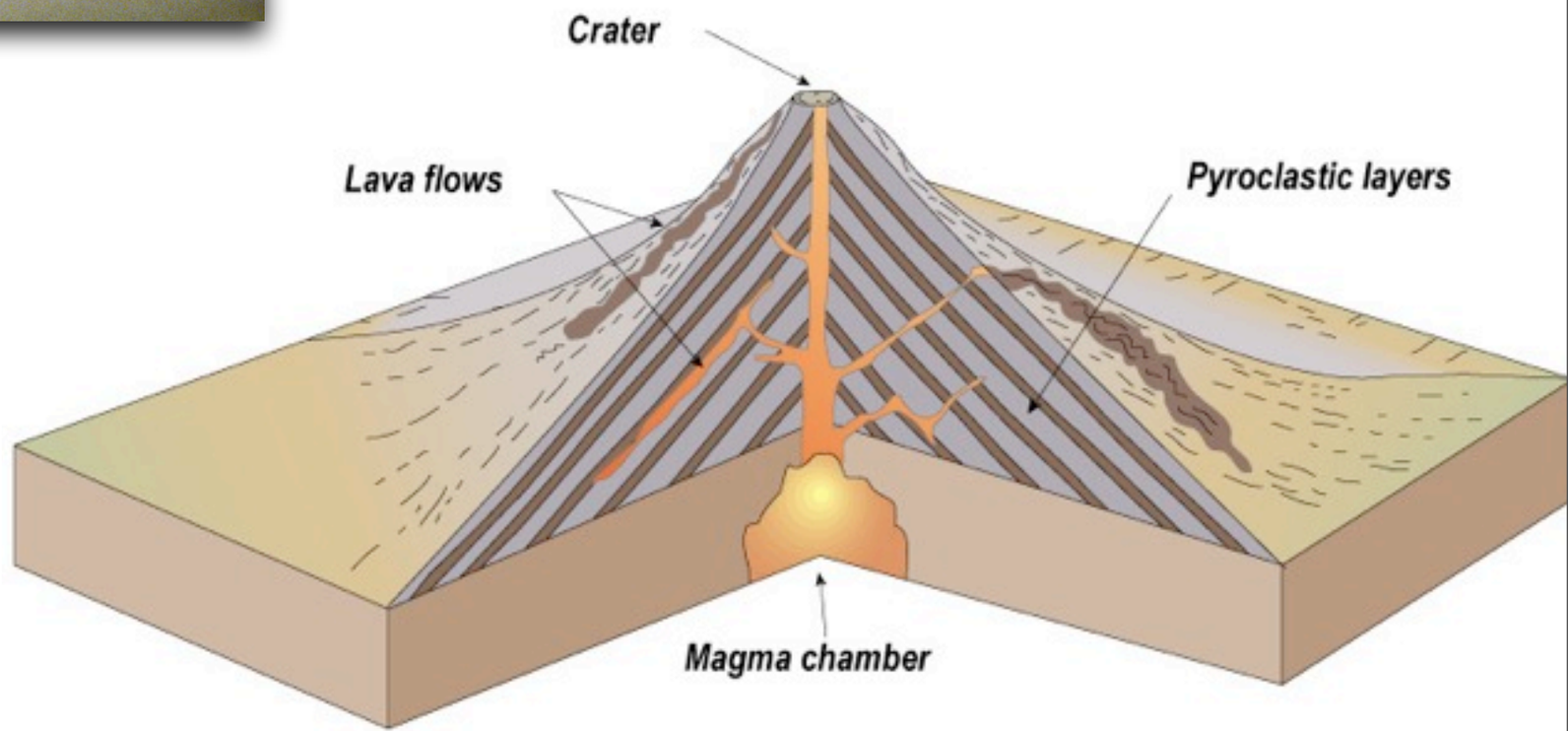
Stratovolcano (Composite Cone)

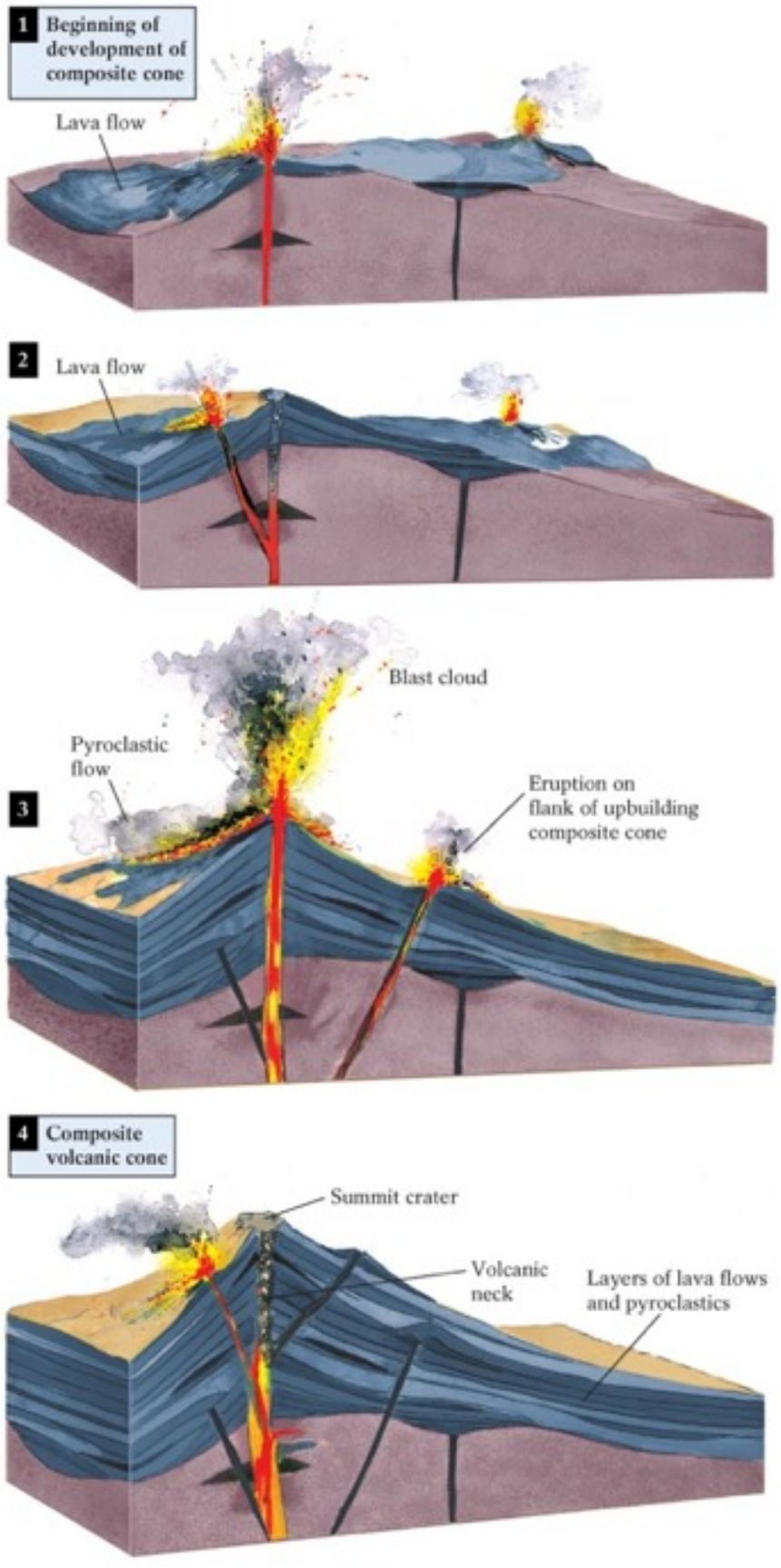
Volume: Large
Viscosity: High
Volatiles: High

Explosivity: High
Composition: Andesite



Andesite (intermediate)

Stratovolcano (Composite Cone)

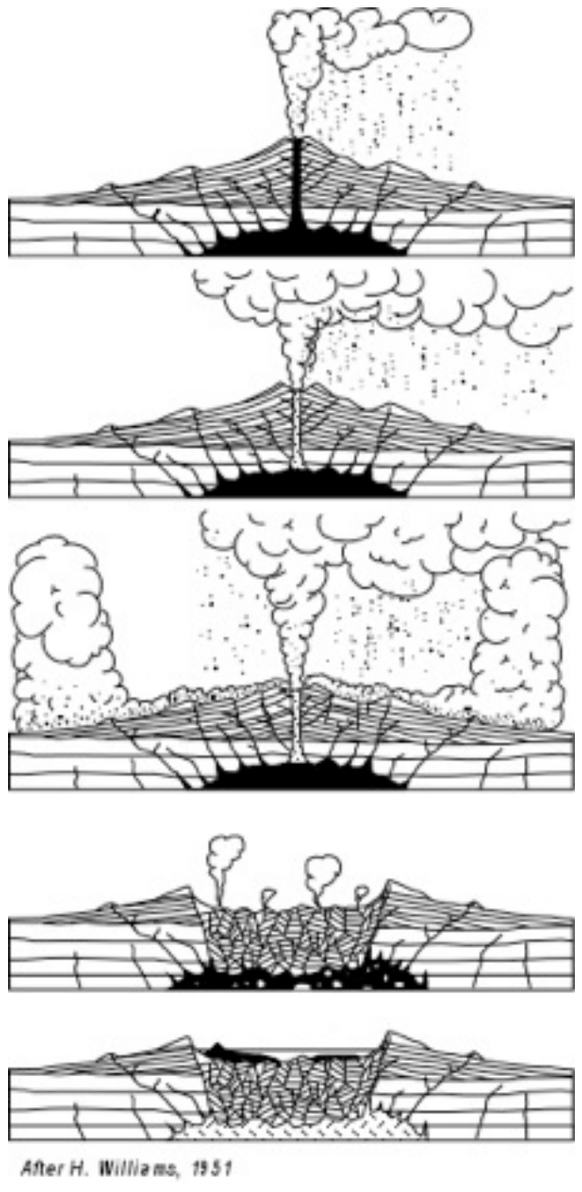


Stratovolcano Eruption (Plinian)

Pinatubo, Philippines (1991)

Sarychev, Russia (2009)

Crater Lake, Oregon



After H. Williams, 1951

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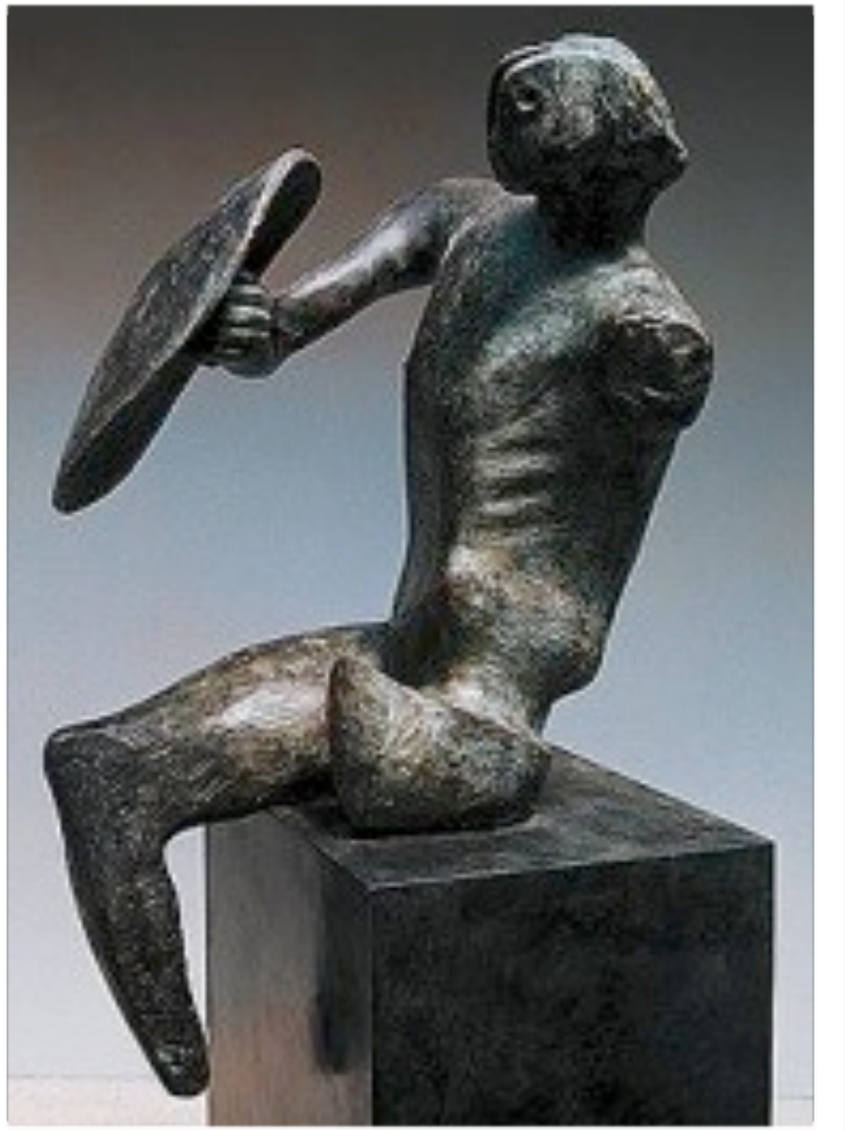
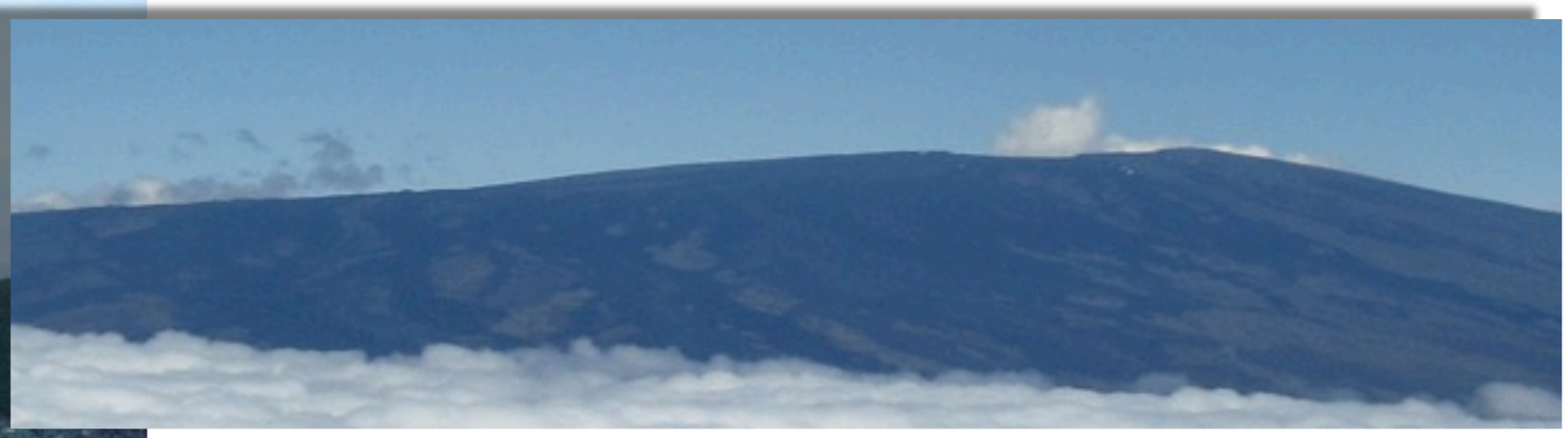
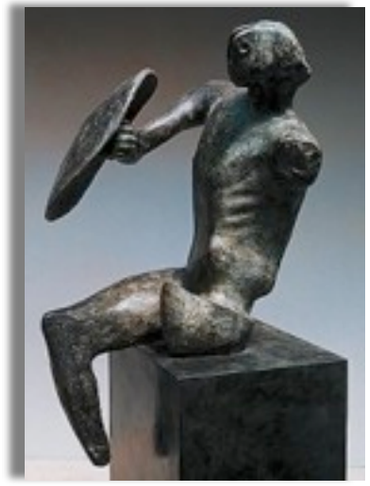


Shield Volcano Eruption (effusive)

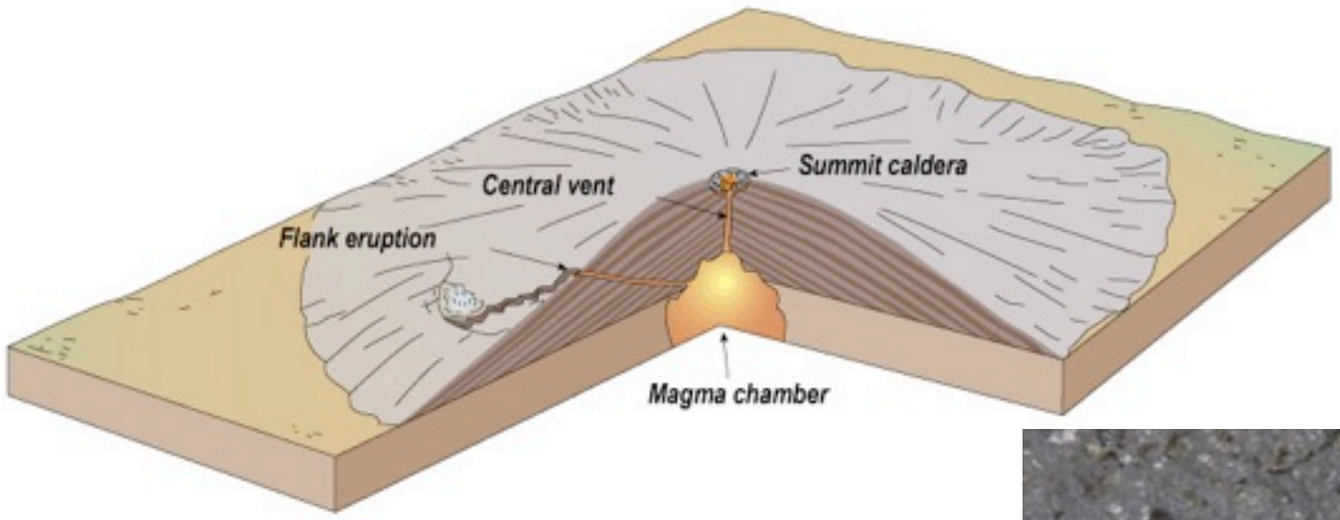


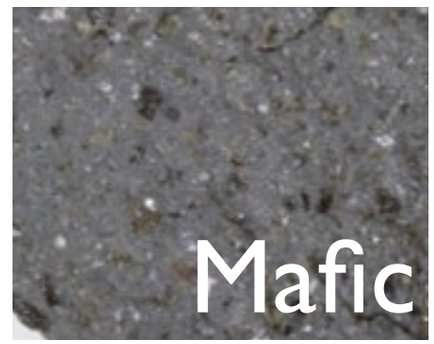
Shield Volcano

Volume: Very Large
Viscosity: Low
Volatiles: Low

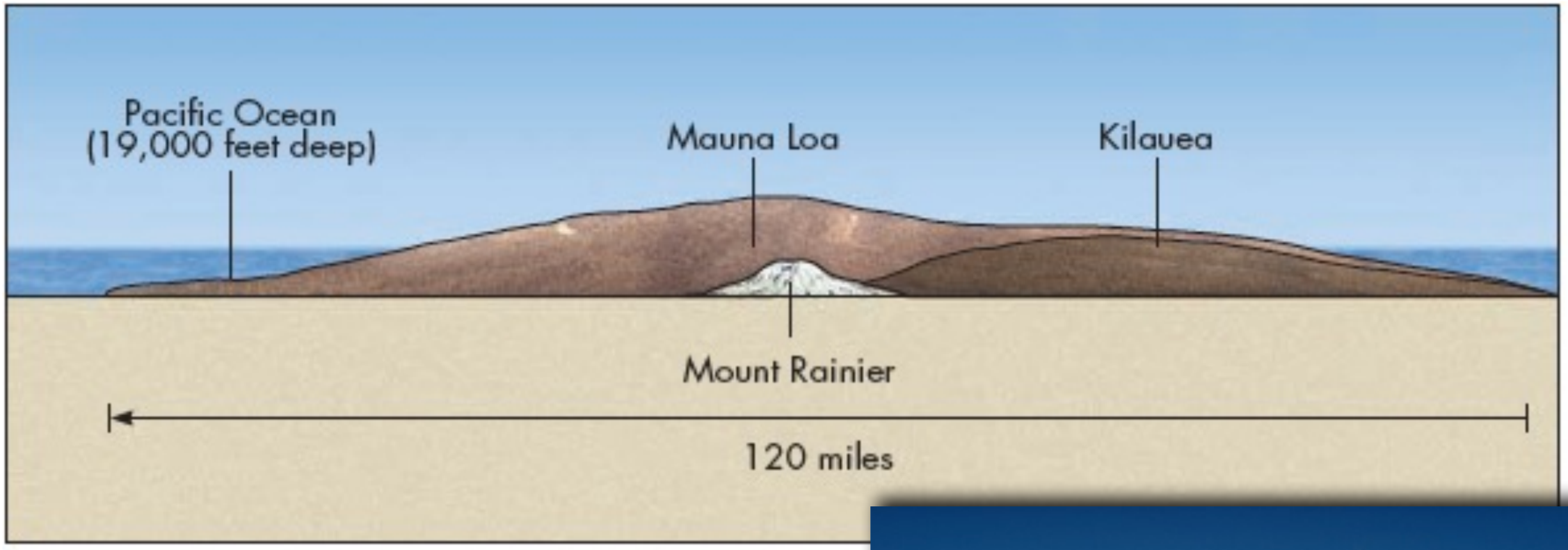


Explosivity: Low
Composition: Basalt





Volcano Size/Volume Comparison



Don’t Mess with Pele’
“Goddess of the Volcano”

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Eruption of a Scoria/Cinder cone

Paracutin, Mexico

Volume: Low
Viscosity: Low
Volatiles: Medium

Explosivity: Low-medium
Composition: Basalt

Scoria

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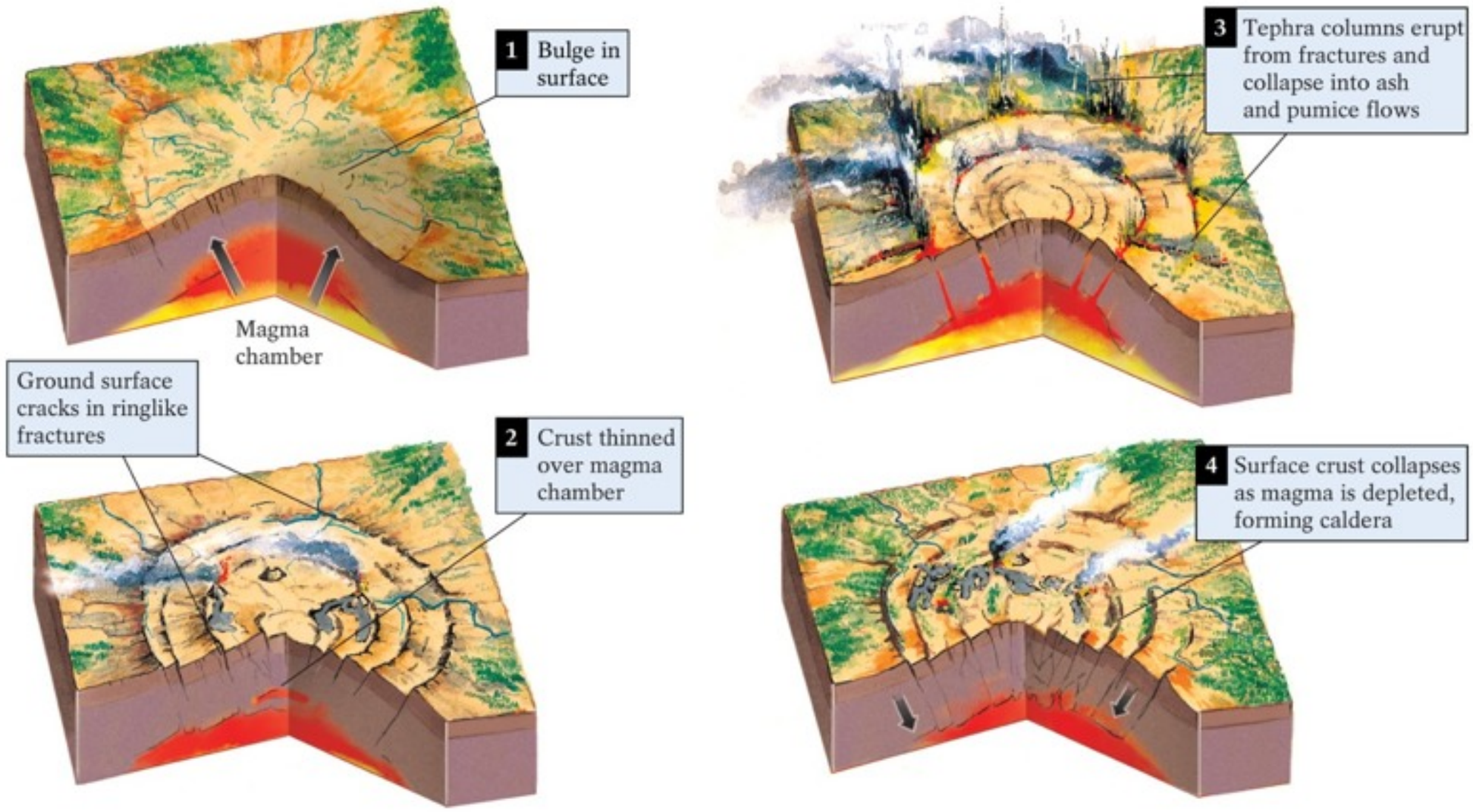
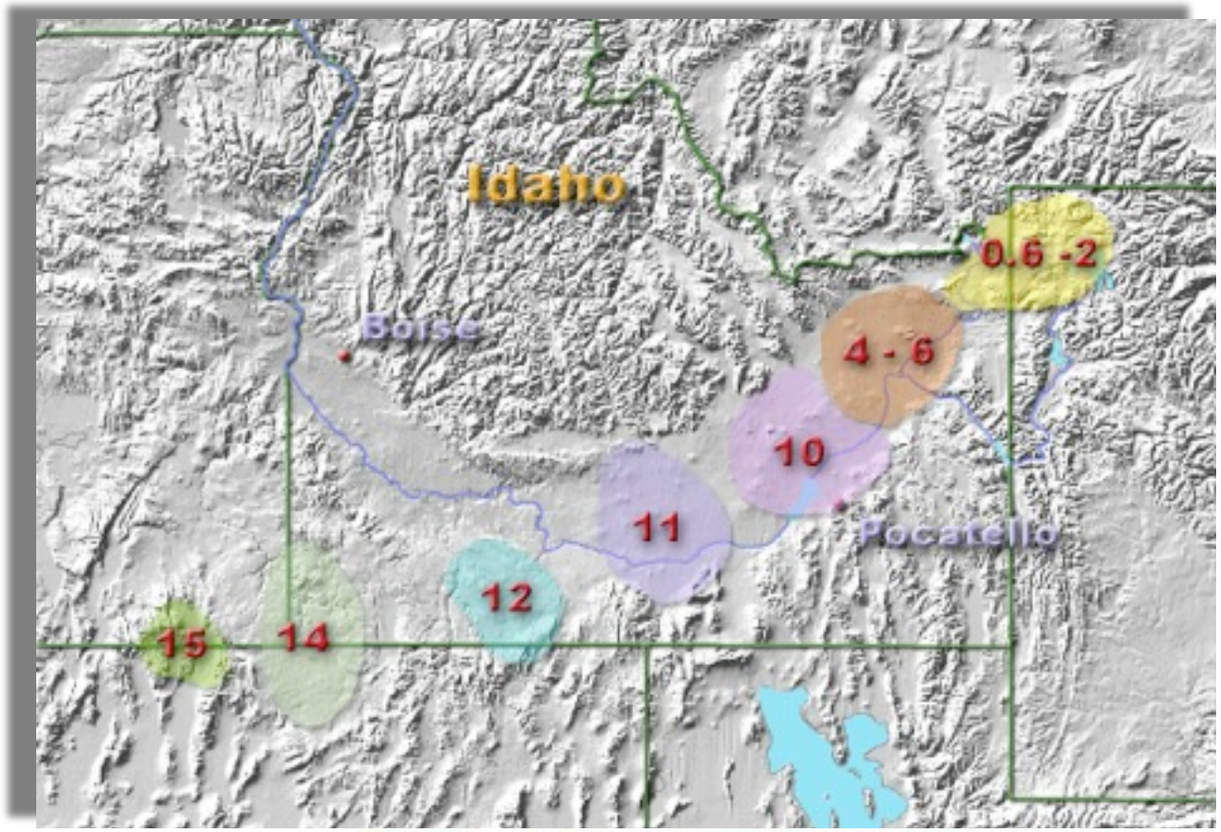
Continental Caldera

Volume: Very High
Viscosity: High
Volatiles: High

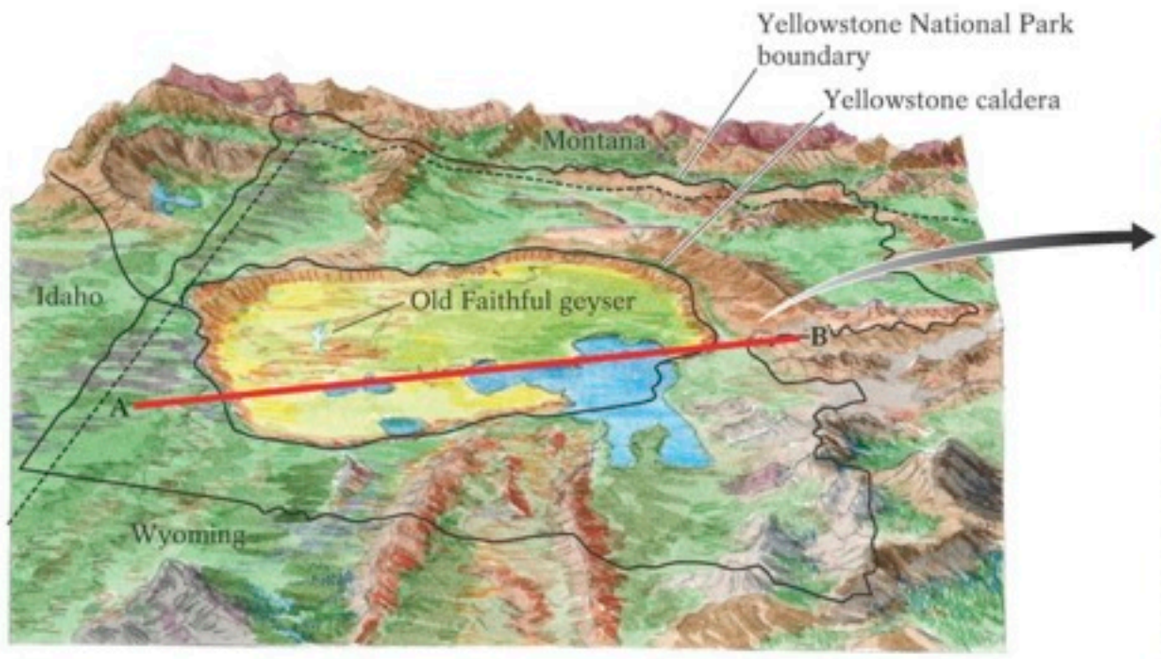
Explosivity: Very High
Composition: Rhyolite

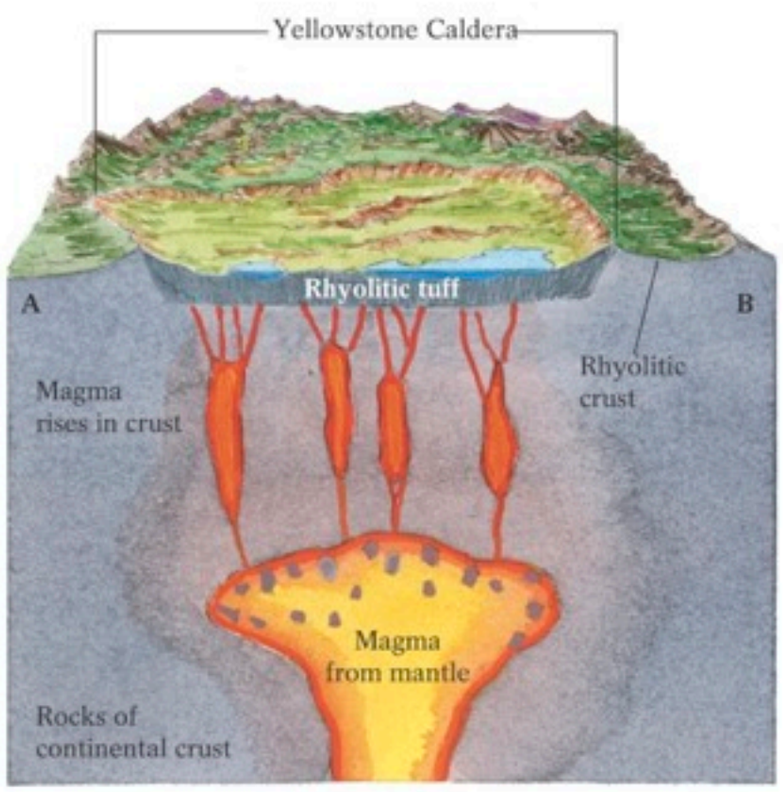


Continental Caldera



Yellowstone

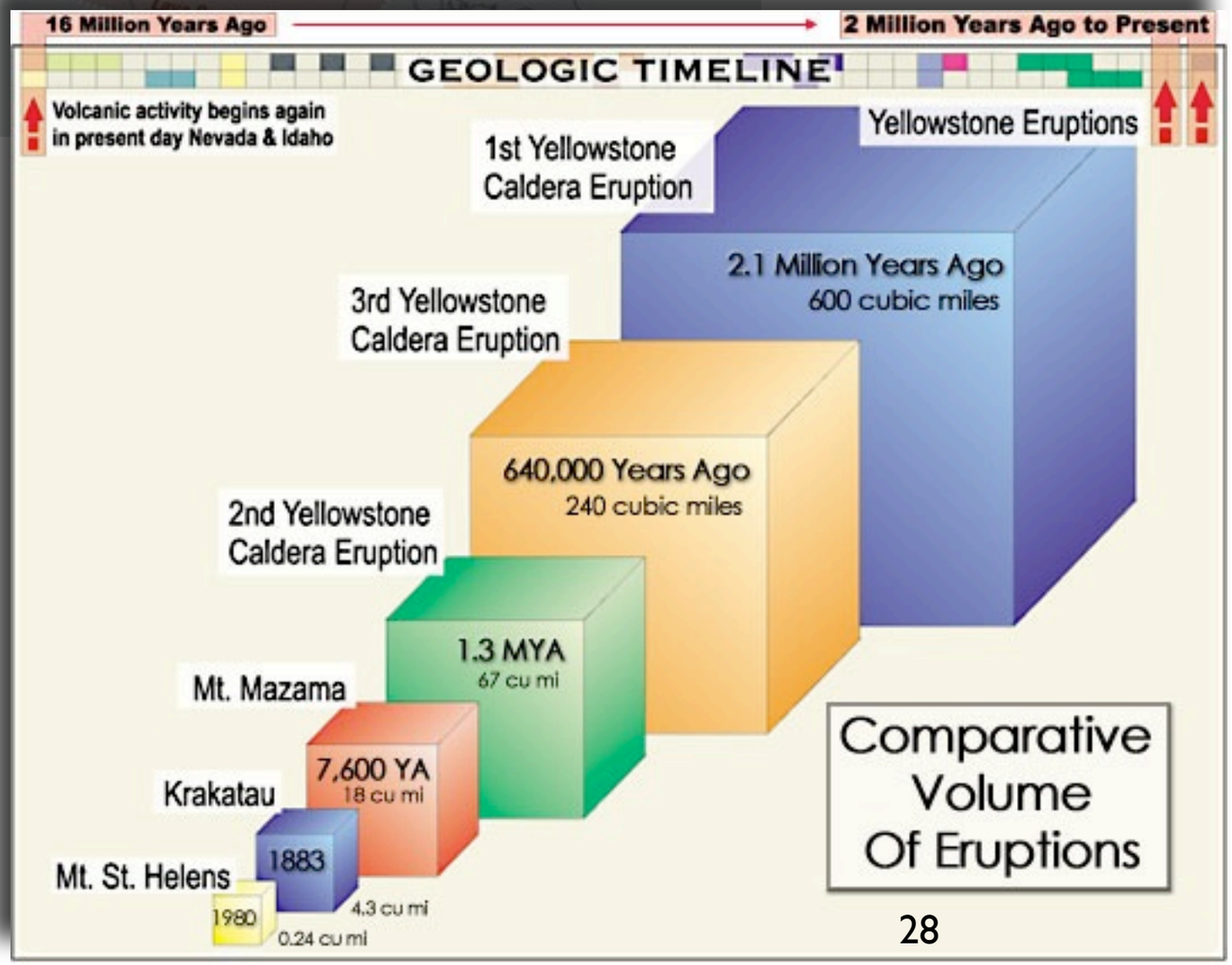


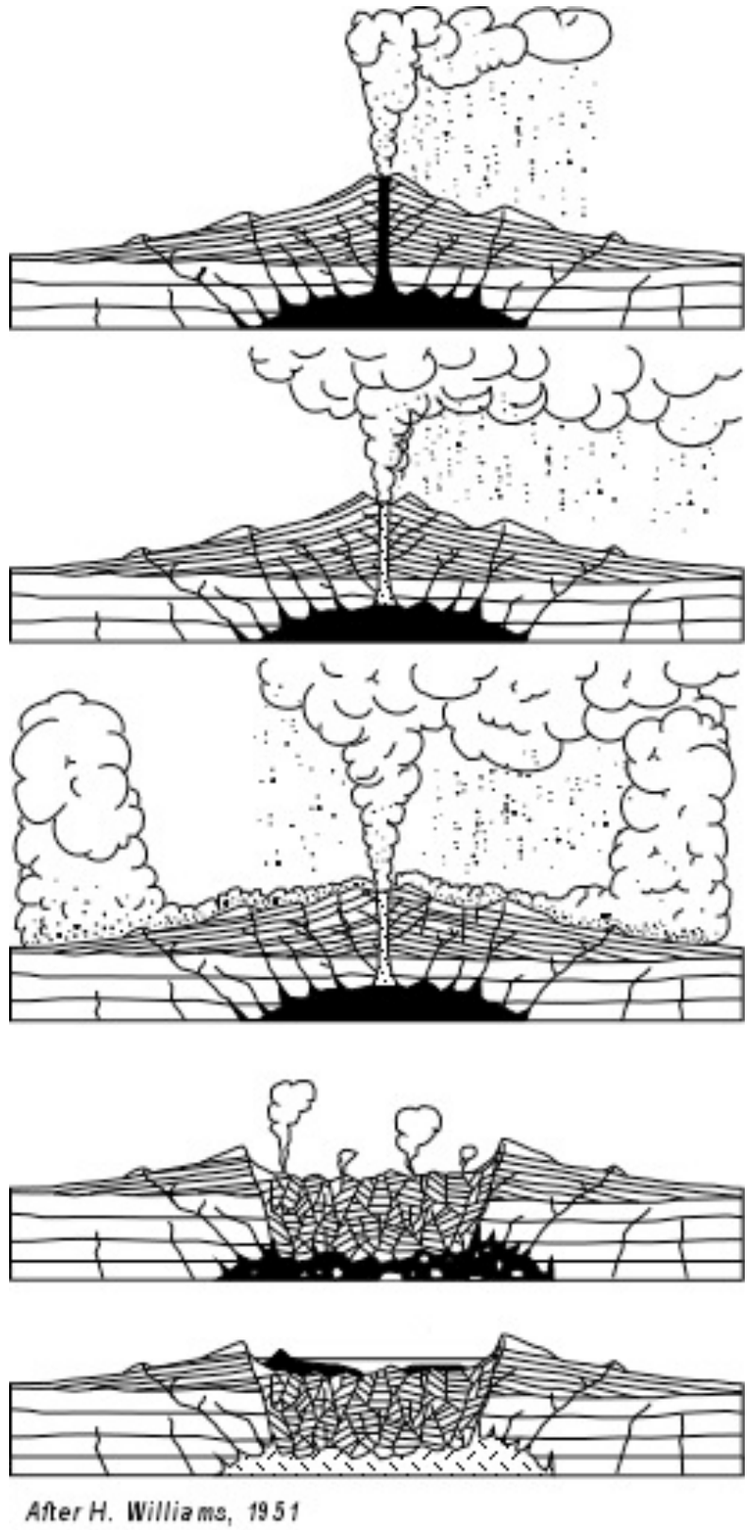


Continental Caldera

Long Valley Caldera, CA

Eruption of a Continental Caldera





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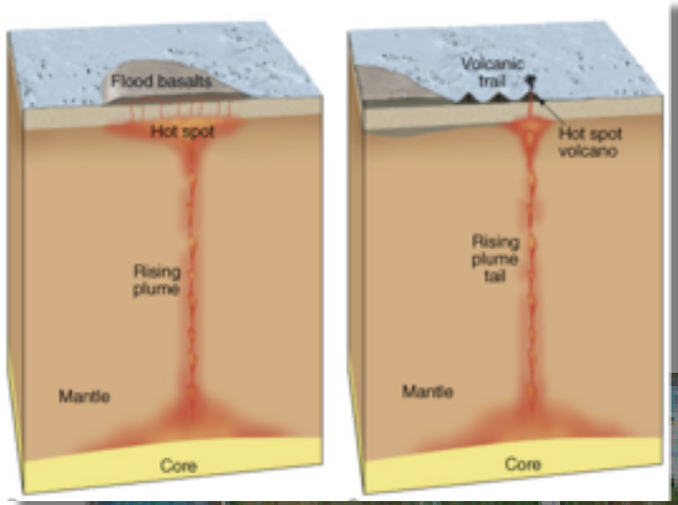
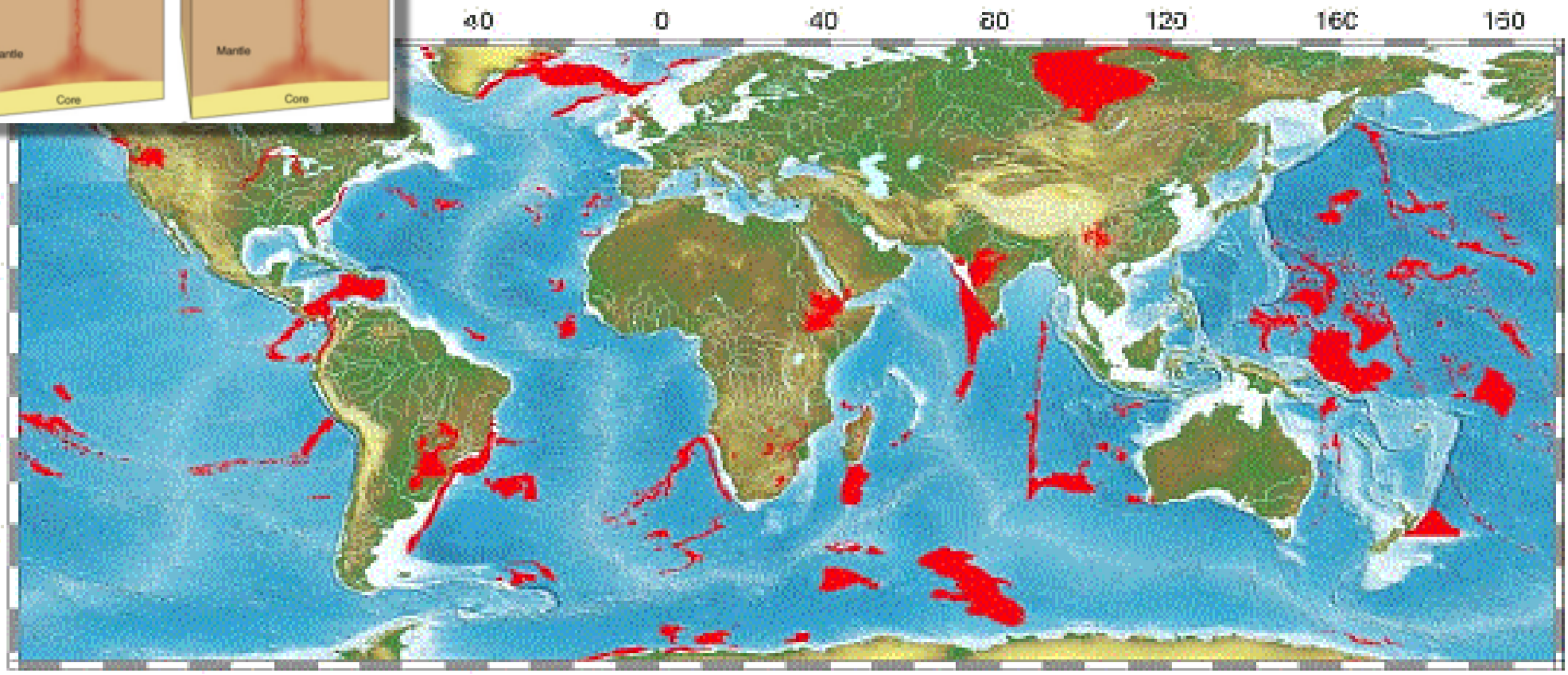
Flood Basalt



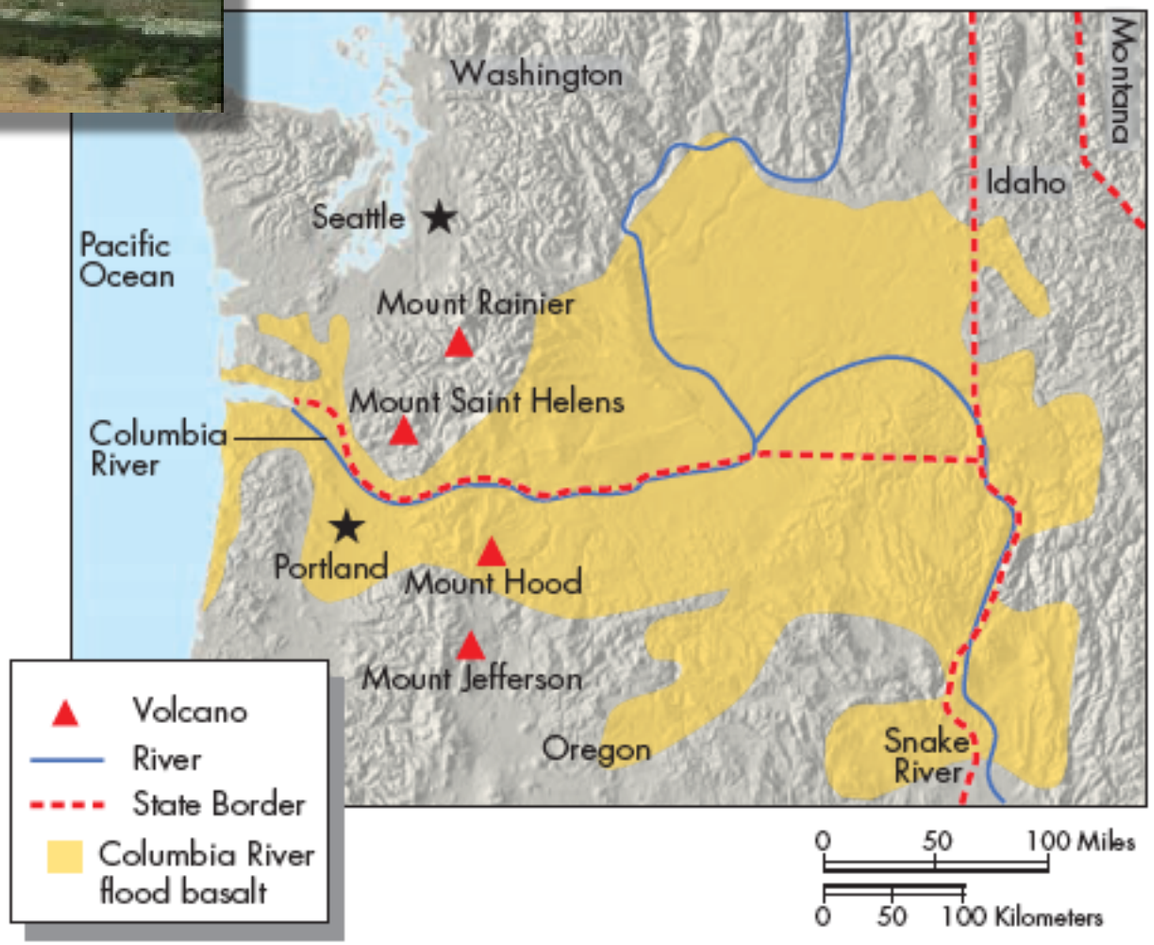


Volume: Very Large Viscosity: Low Volatiles: Low

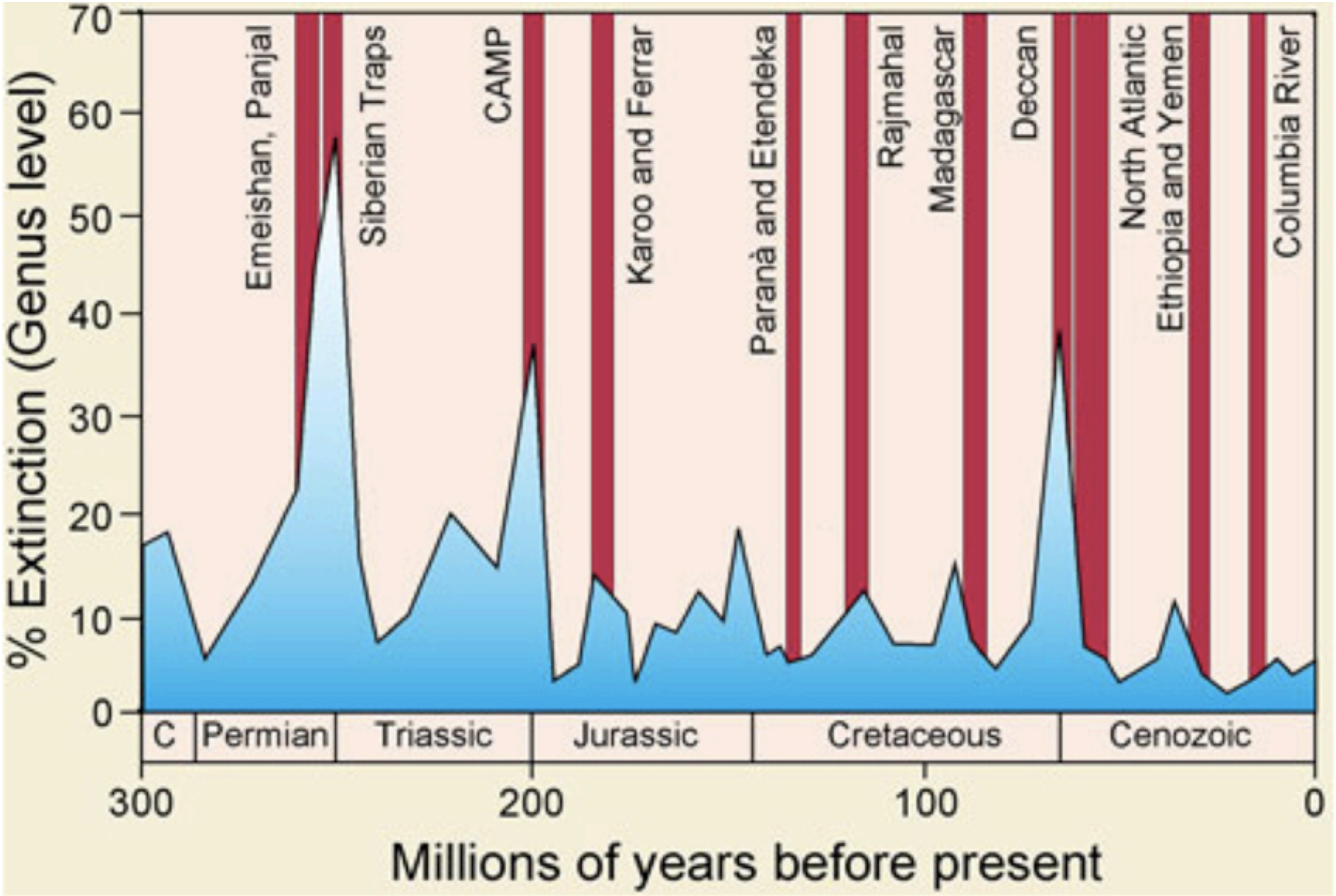
Explosivity: Low
Composition: Basalt

Flood Basalt

Columbia River Basalt
(17.5 -17.6 Ma)

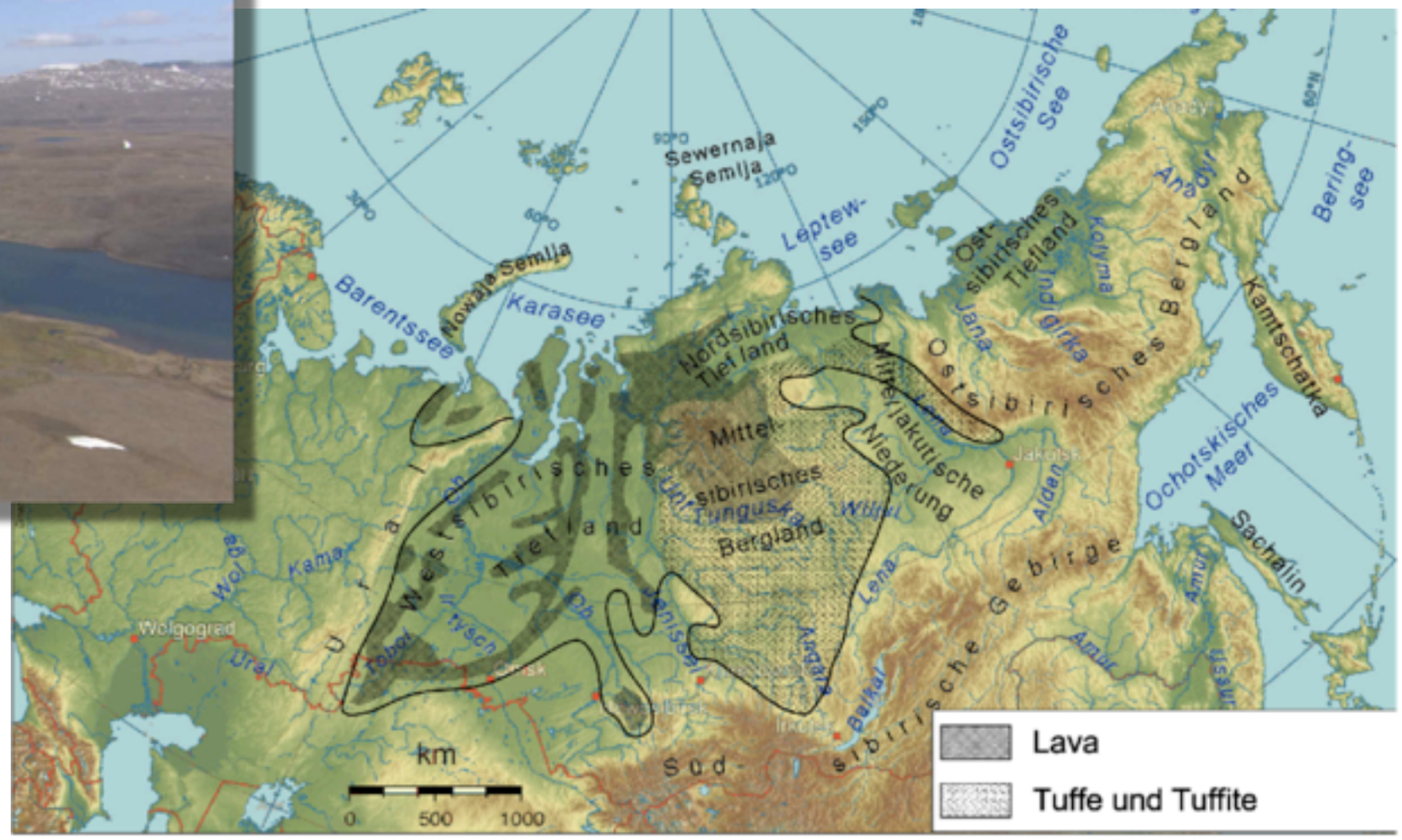


Relationship between Flood Basalts and Mass Extinctions



Flood Basalt

Deccan Traps India (65 Ma)
512,000 km^3



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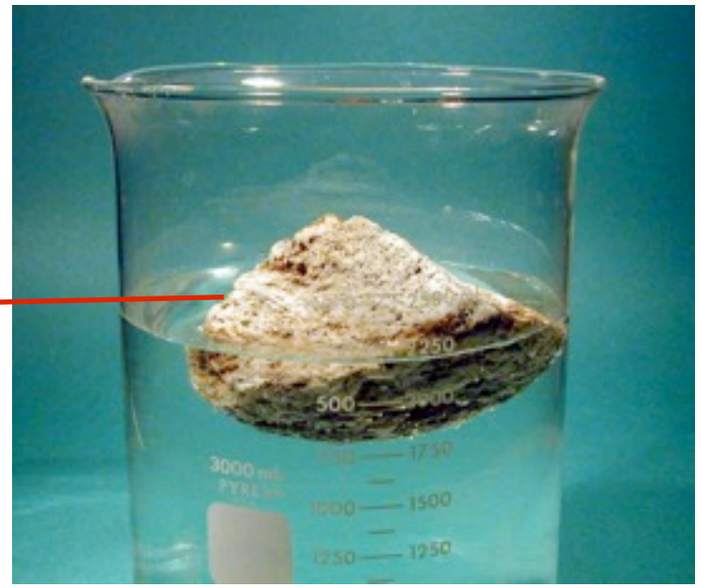
Lava Dome

Novarupta
Alaska

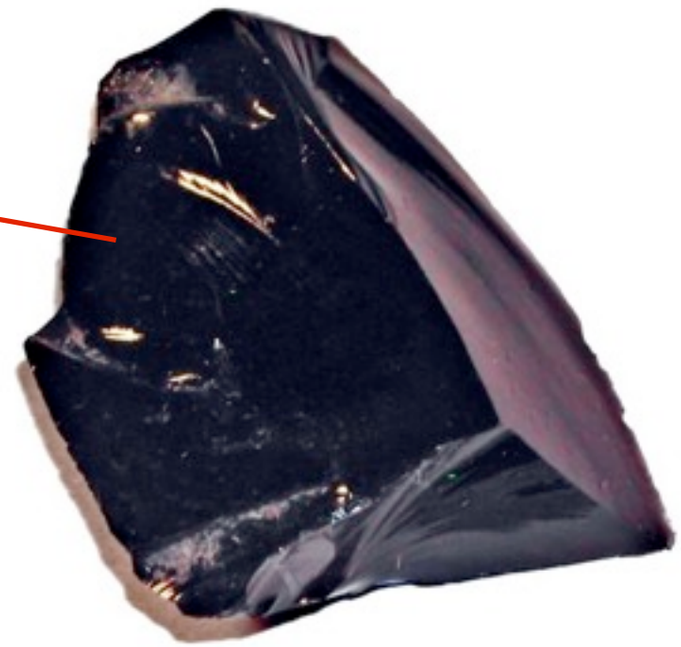
Volume: Low-Medium Viscosity: High Volatiles: Low

Explosivity: Low
Composition: Rhyolite

Pumice and Volcanic Glass



Pumice

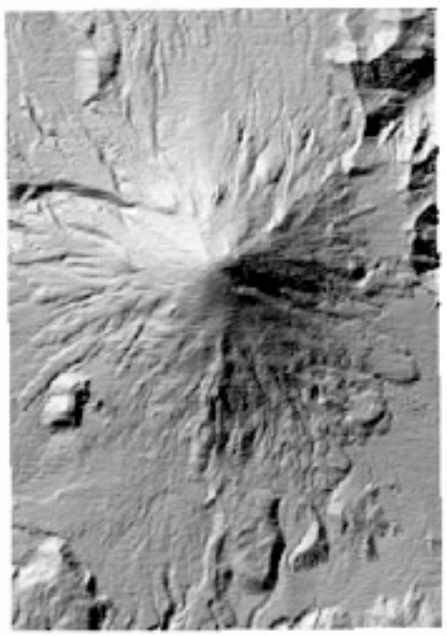


Obsidian Glass

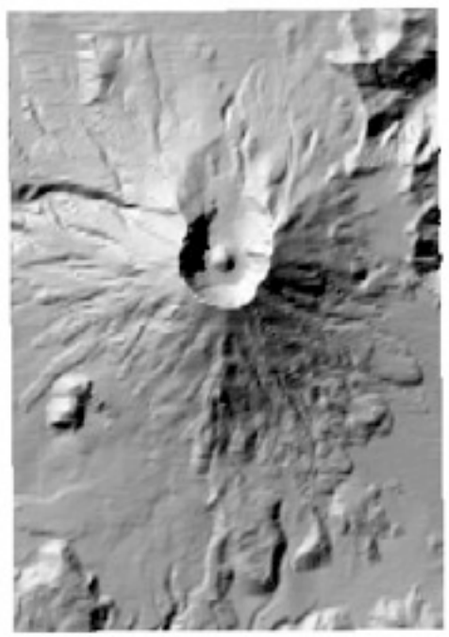
Lava Dome

Following the 1980 Eruption of Mount St. Helens the vent has become plugged by a growing lava dome

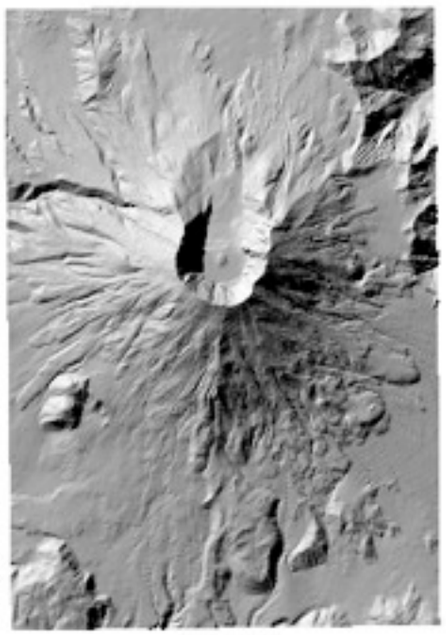
Episodic growth of a Lava Dome



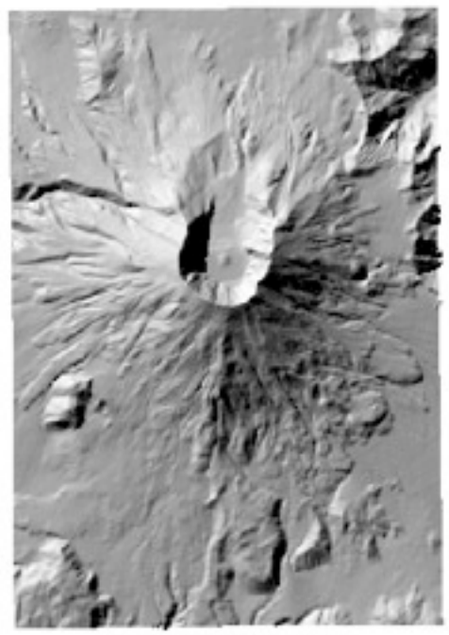
before



after



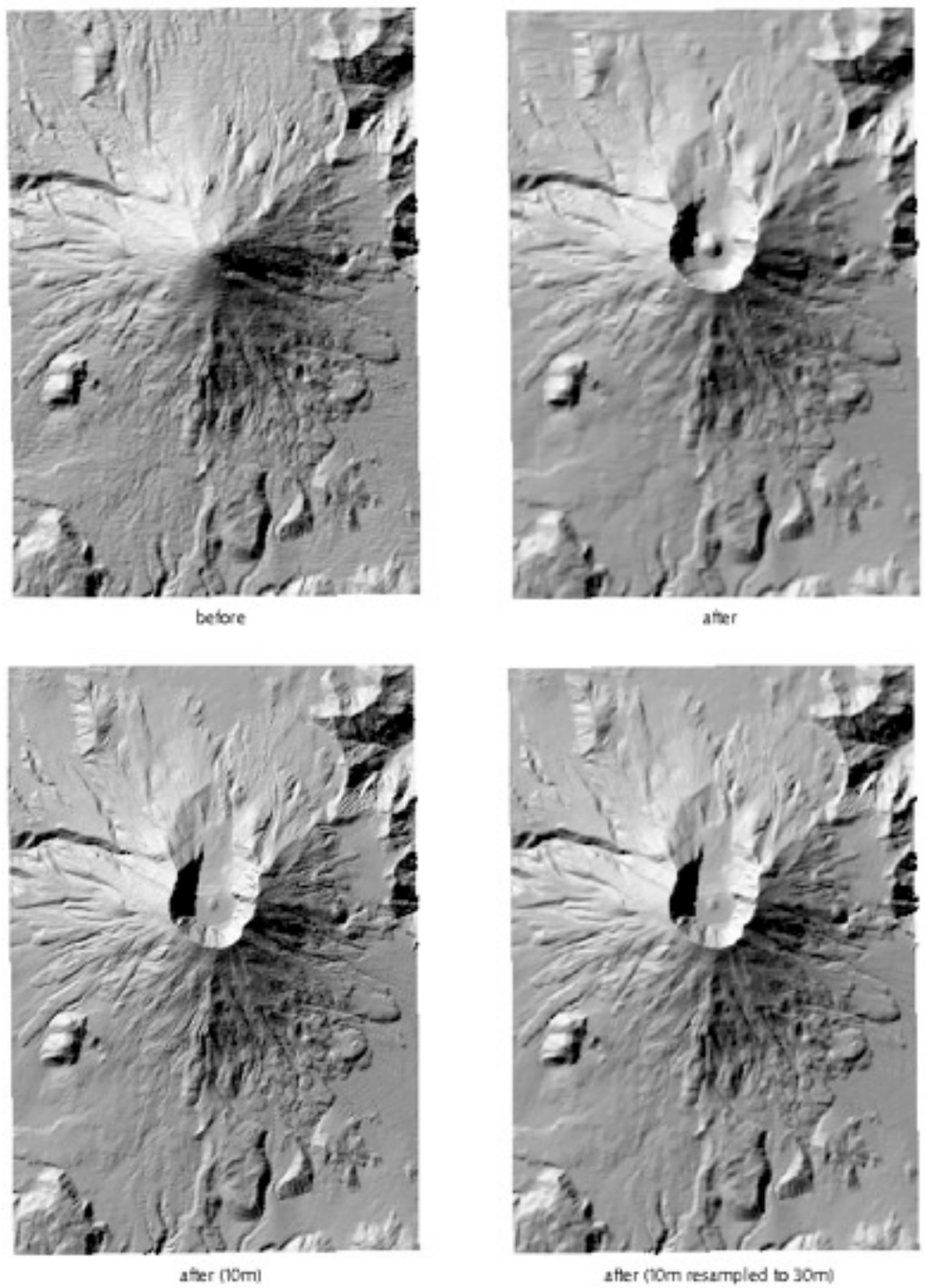
after (10m)

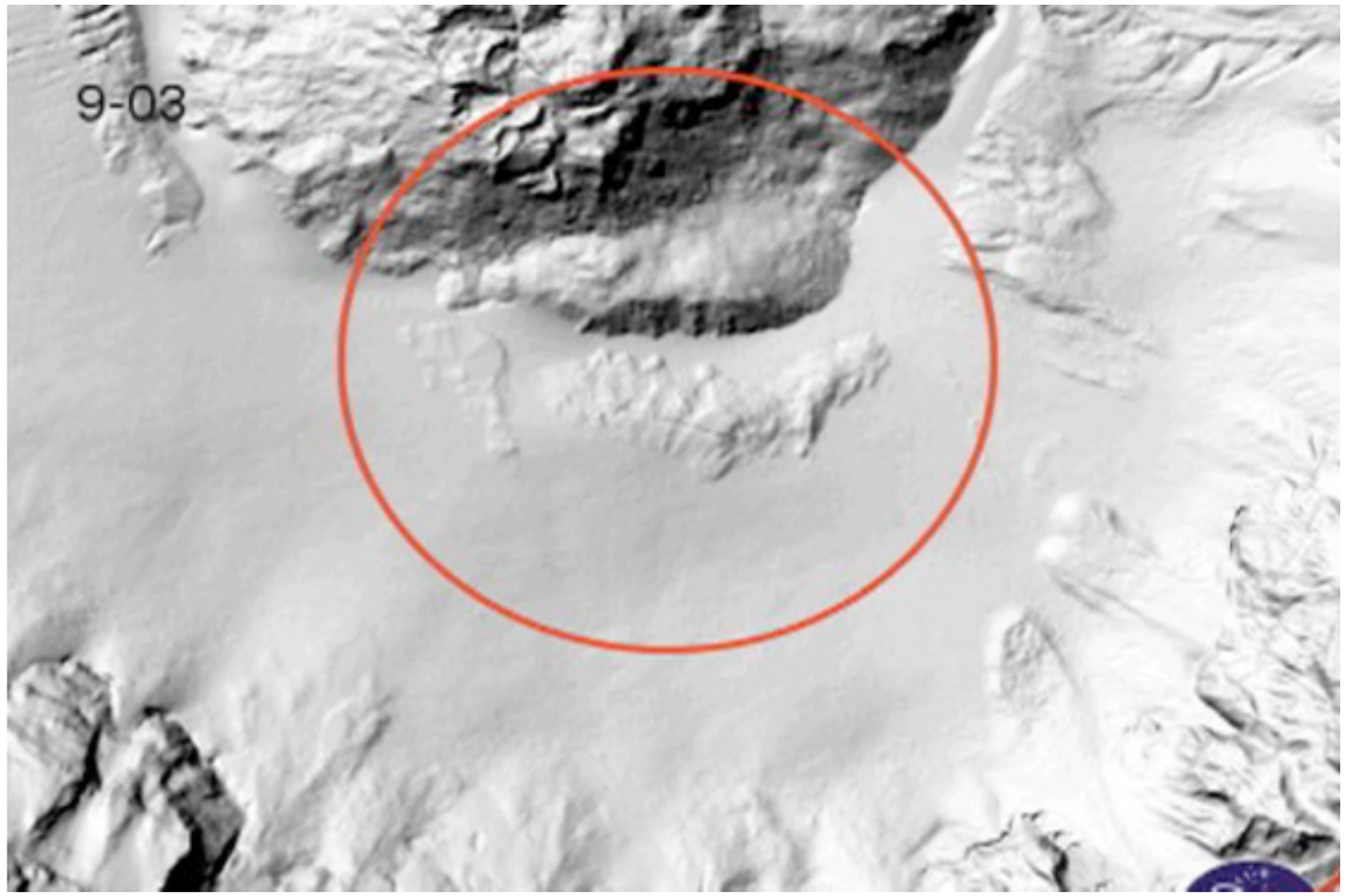


after (10m resampled to 30m)

Following the 1980 Eruption of Mount St. Helens the vent has become plugged by a growing lava dome

Episodic growth of a Lava Dome





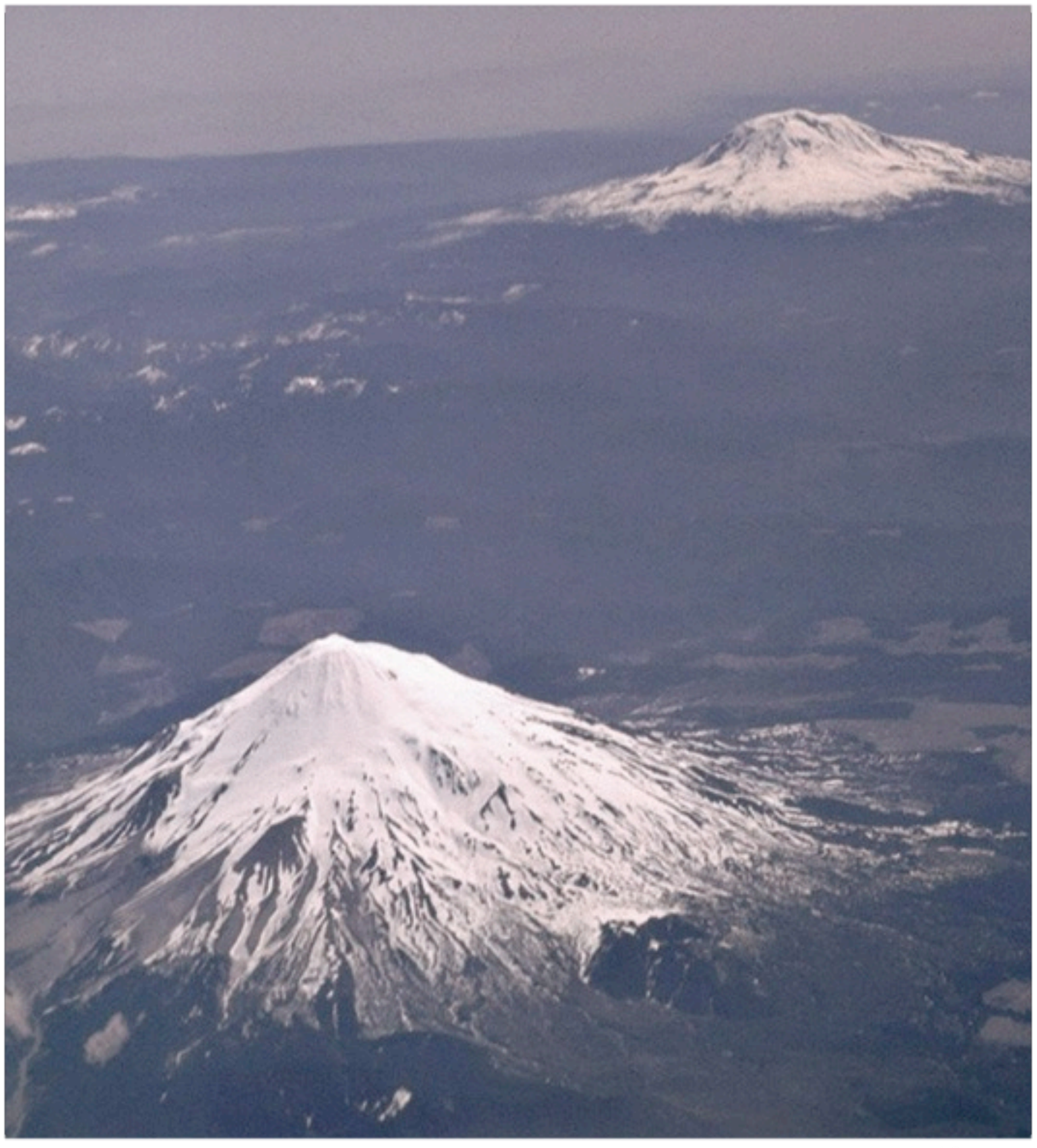
Following the 1980 Eruption of Mount St. Helens the vent has become plugged by a growing lava dome

Anatomy of a Plinian Eruption (Stratovolcano)

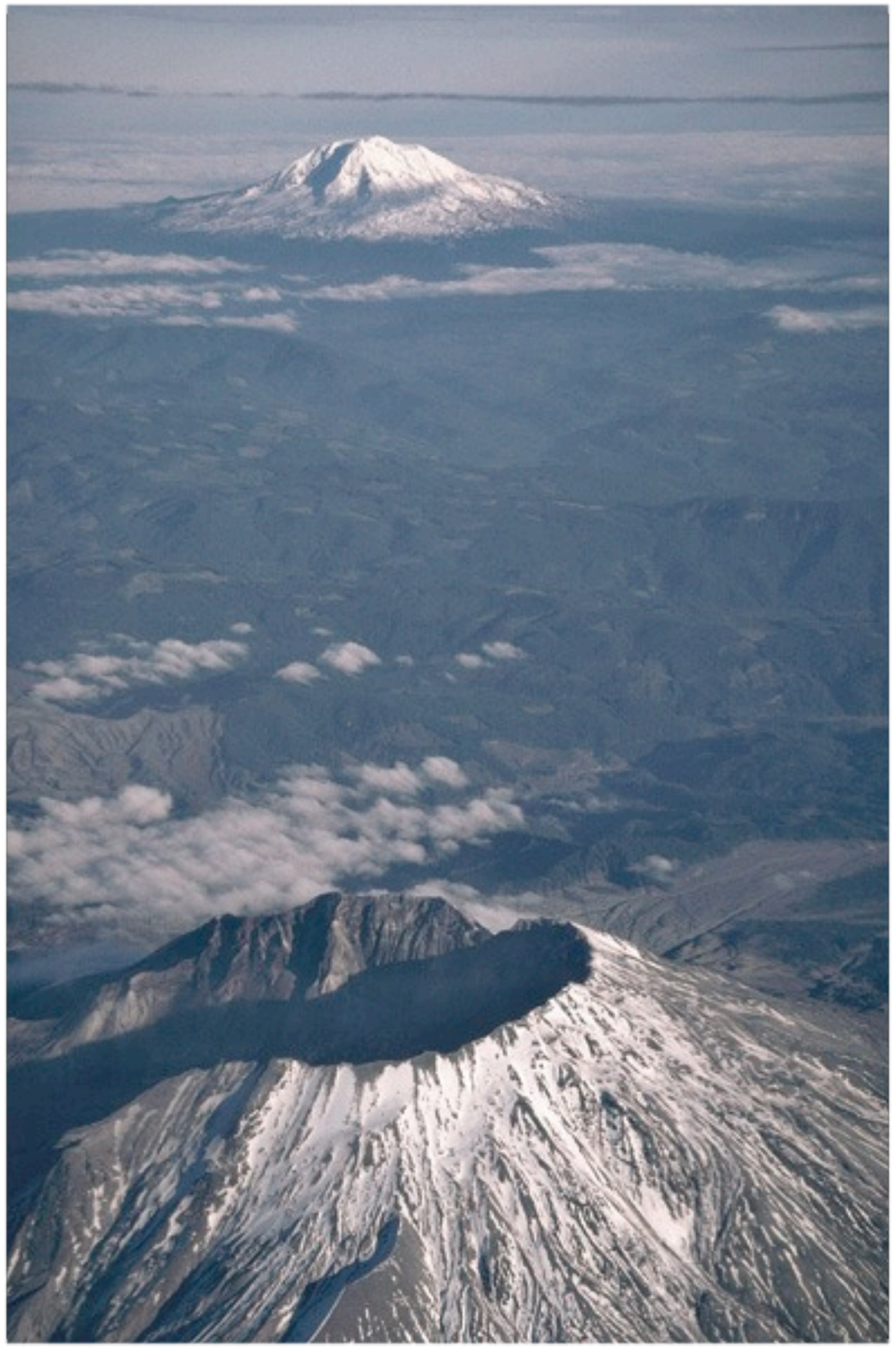
Hazards associated with the 1980 Eruption of Mt St. Helens, Washington

Mt. Saint Helens

Before



After

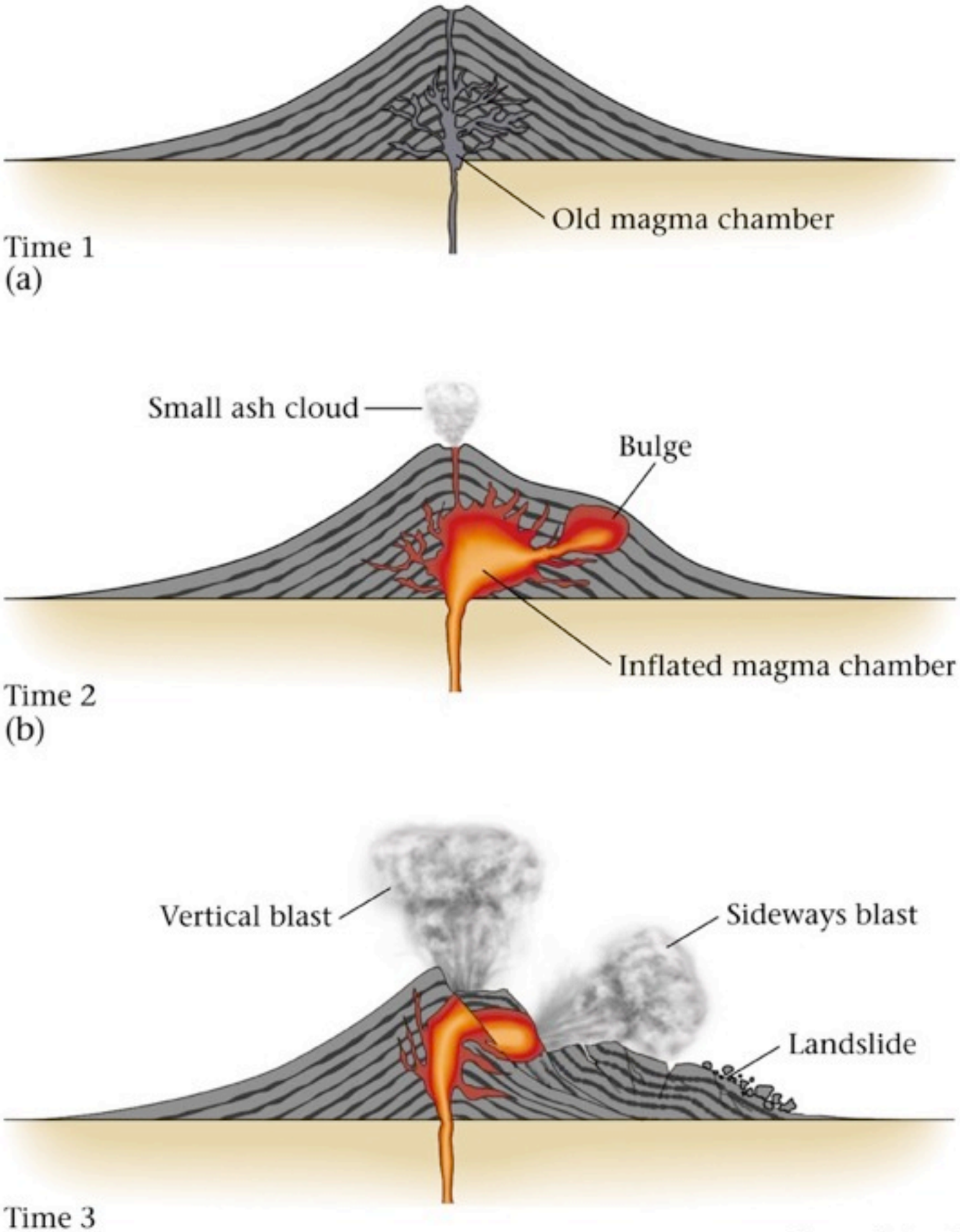


Mt. Saint Helens

Mt. Saint Helens

After

Mt. St. Helens 1980 Eruption



Bulge on the North flank

Mt. Saint Helens Eruption Sequence

Bulge on the North flank

Mt. Saint Helens Eruption Sequence

Magnitude 5 Earthquake triggers the largest recorded landslide.

Mt. Saint Helens Eruption Sequence

Removal of overburden, decompresses the magma below initiating a lateral blast from the north flank

Mt. Saint Helens Eruption Sequence

Expanding gasses blast from the flank a of the volcano at speeds >300 mph

Mt. Saint Helens Eruption Sequence

Johnston Ridge is enveloped in overrun by landslide debris as hot gasses climb skyward

Mt. Saint Helens Eruption Sequence

Eruption column rises to 80,000 ft in 15 minutes

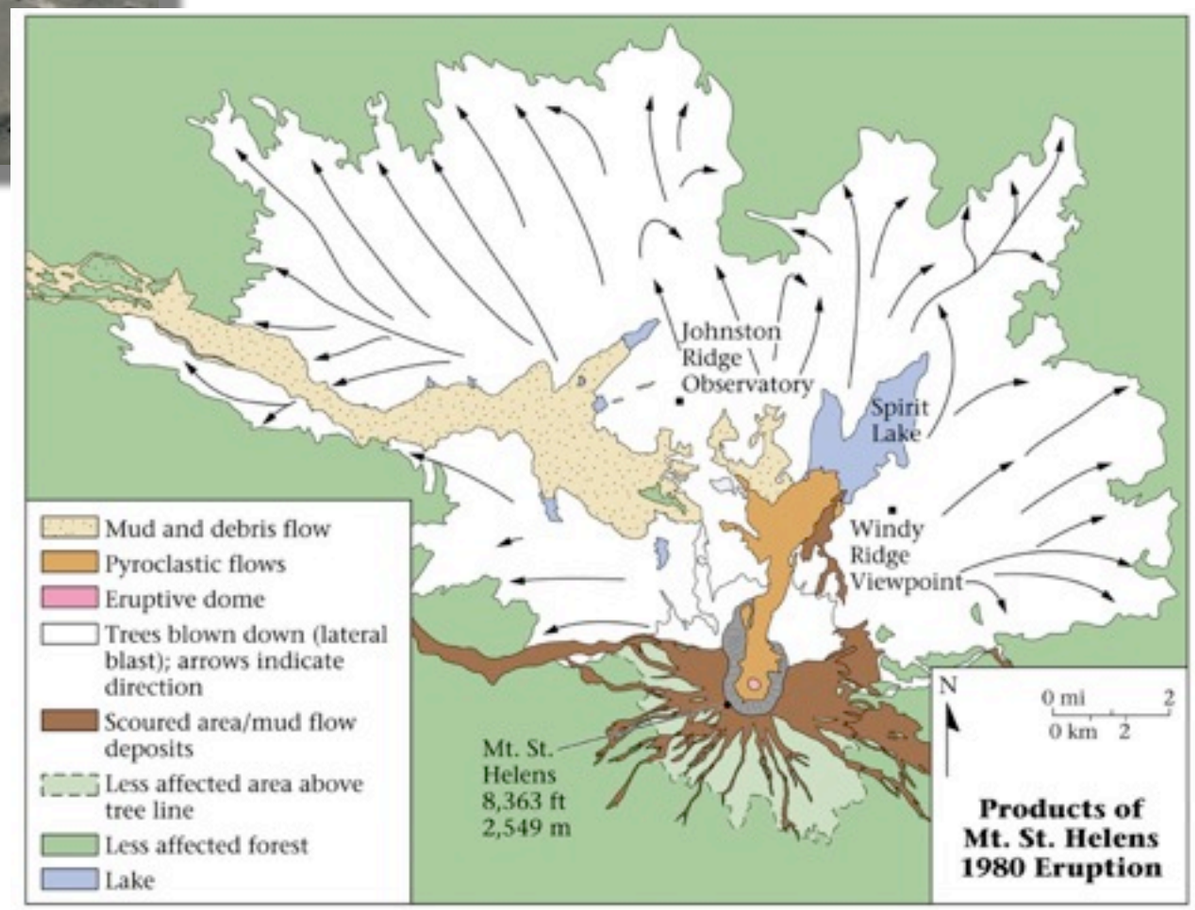
David Johnston

View from Johnston Ridge

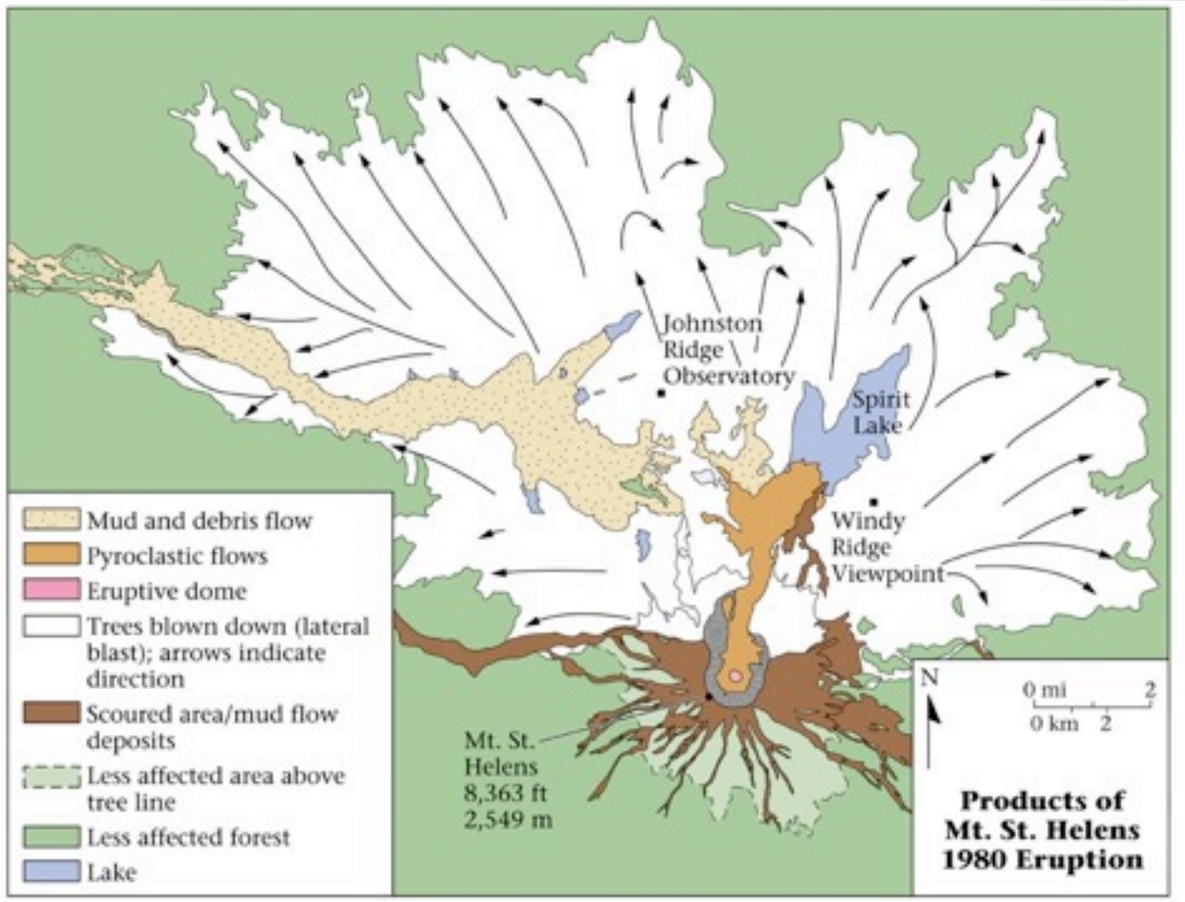
"Vancouver! Vancouver! This is it! Vancouver! Vancouver! Is the transmitter still working?" Dave Johnston

Photograph from Johnston Ridge

The Landslide

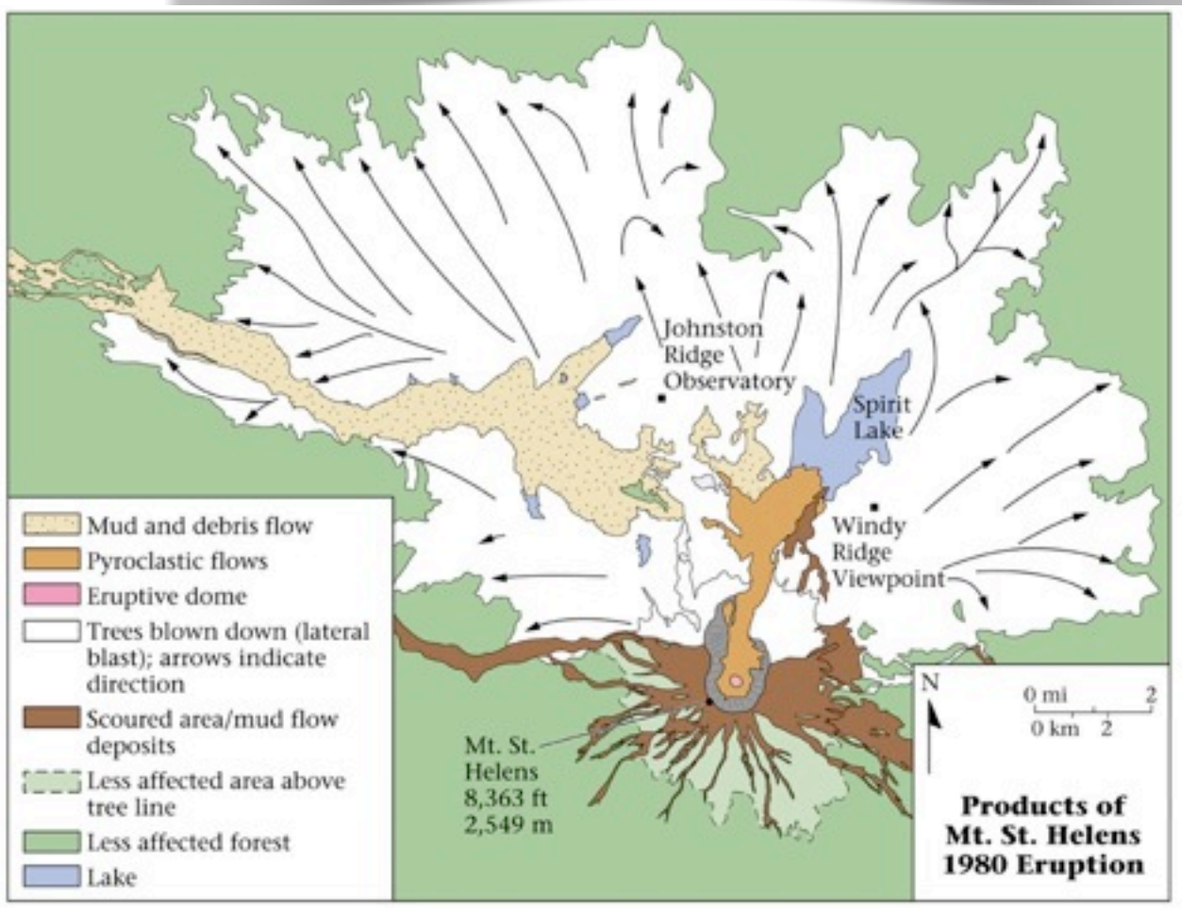


Lateral Blast Shockwave Damage



Lahar - Hot Mud flow

Volcanos, Peter Francis



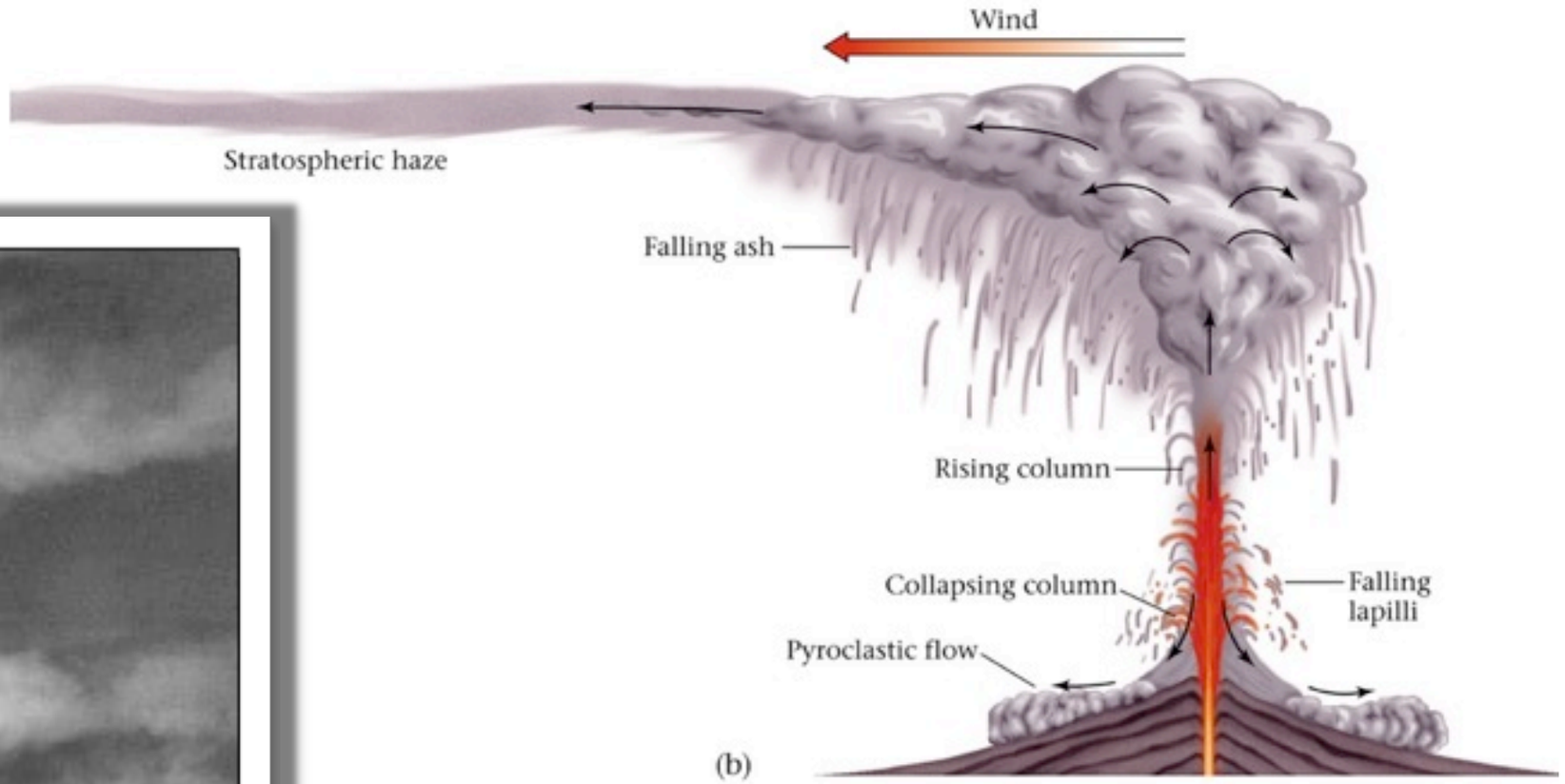
Lahar - Hot Mud flow

High Density Flow

What goes up....

Chiatin Volcano (2008), Chile

Mt. St Helens Ash Fallout

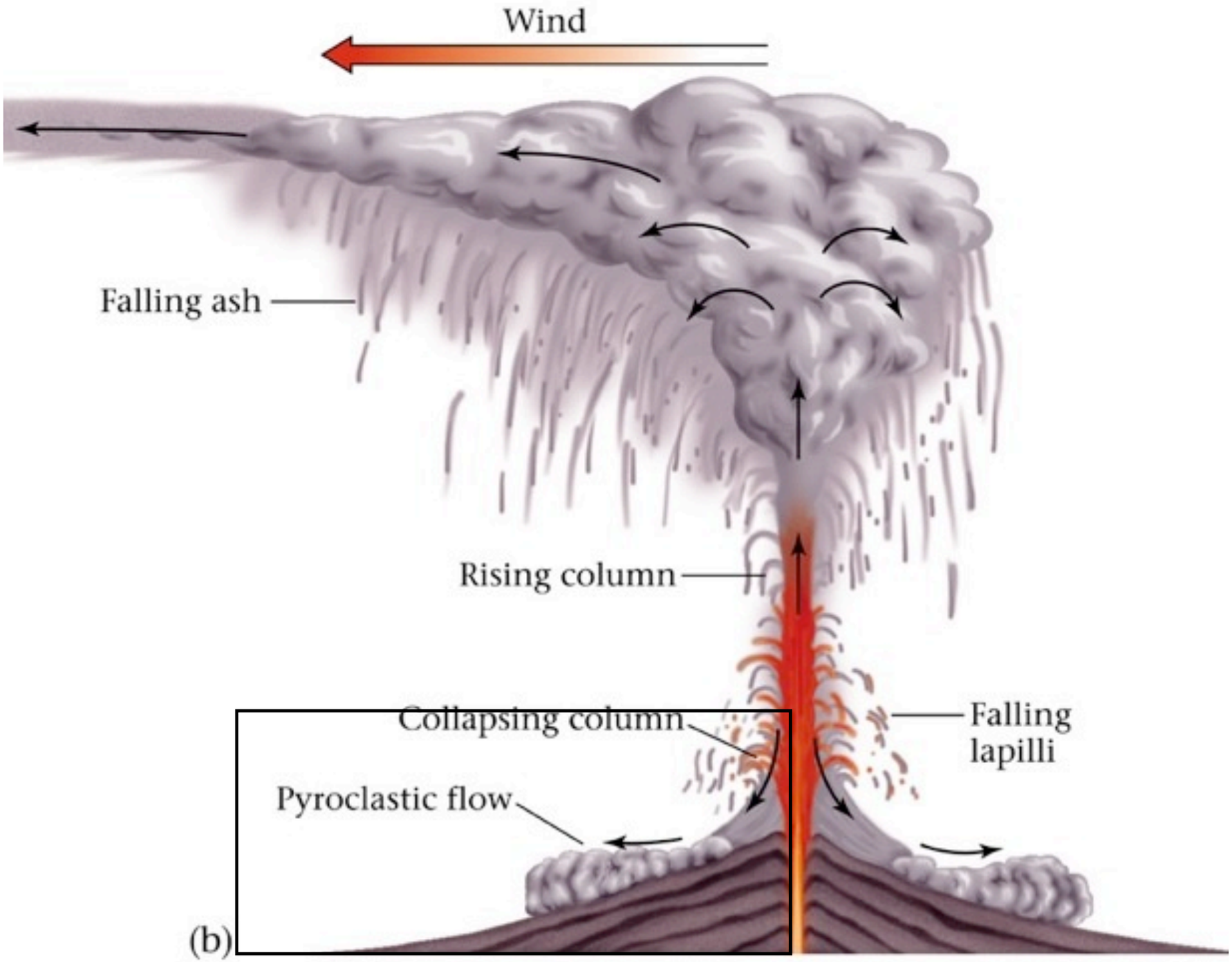


Cold gentle fall-out

Ash Fall Tuff

Mt. Pinatubo (1991) Luzon, Philippine Islands

Pyroclastic Flows



Hot violent flow

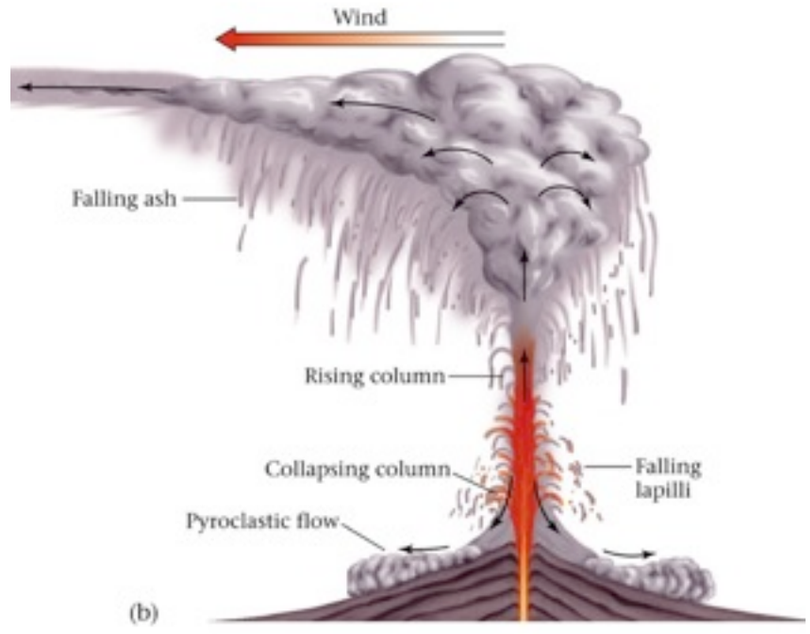
St. Helens (1980)

Sarychev (2009)

Pyroclastic Flow and Surge

Flows are high density composed of ash, pumice, and rock fragments.

Surges are low density compose of hot gas and ash.



Pyroclastic Flow and Surge

Pyroclastic Flow and Surge

Pyroclastic Flow and Surge

Flows are high density composed of ash, pumice, and rock fragments.

Surges are low density compose of hot gas and ash.

Resurgent Dome (rebirth)

1984

2005

“The Plug”

2005

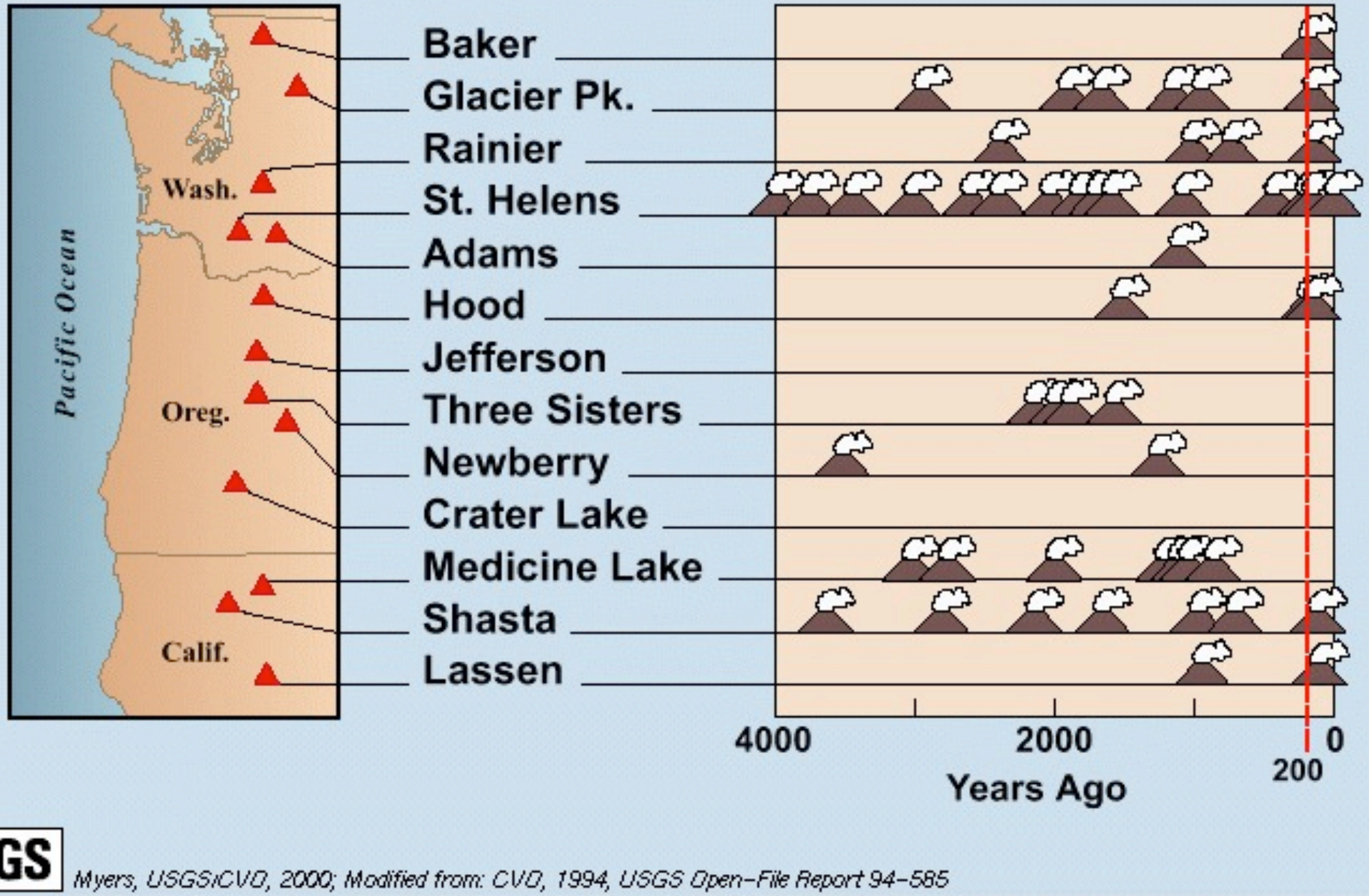
Dome Collapse

Mount Unzen 1991

Pyroclastic Flow or Block and Ash Flow

Pyroclastic Flow or Block and Ash Flow

Cascade Eruptions During The Past 4,000 Years



USGS

Myers, USGS/CVO, 2000; Modified from: CVO, 1994, USGS Open-File Report 94-585