

# Mt Unzen, Japan

1991-93 eruptions

Dormant for  
200 years

Previous  
eruption killed  
15,000 people



# Pyroclastic flow

Commonly  
60-80 mph

Can be  
120-150 mph

\*\*\*\*

**Most deaths and  
damage caused by  
pyroclastic flows**





# Crater Lake, Oregon

A caldera formed by collapse



# Forming a caldera – Crater Lake, Oregon

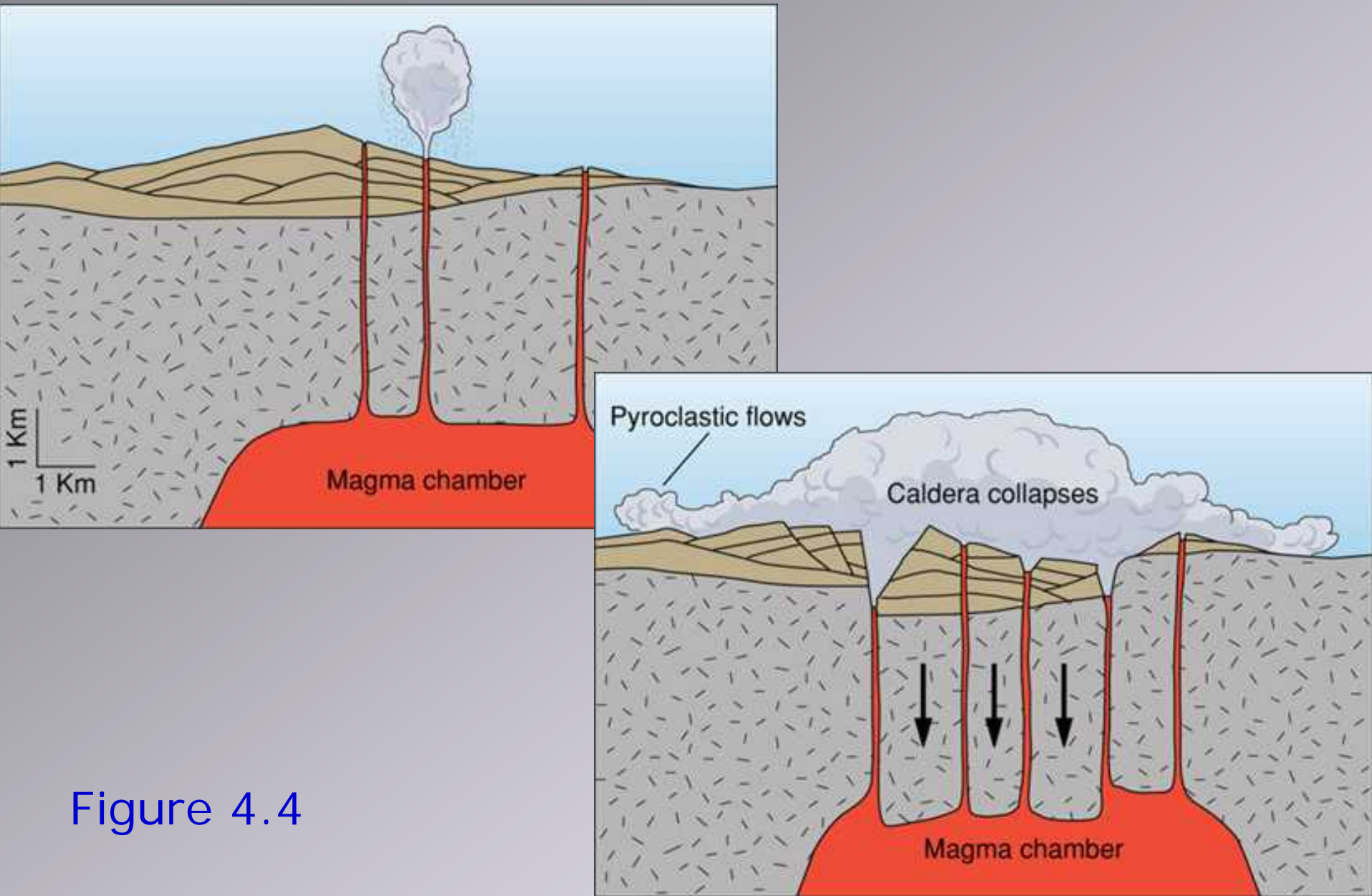
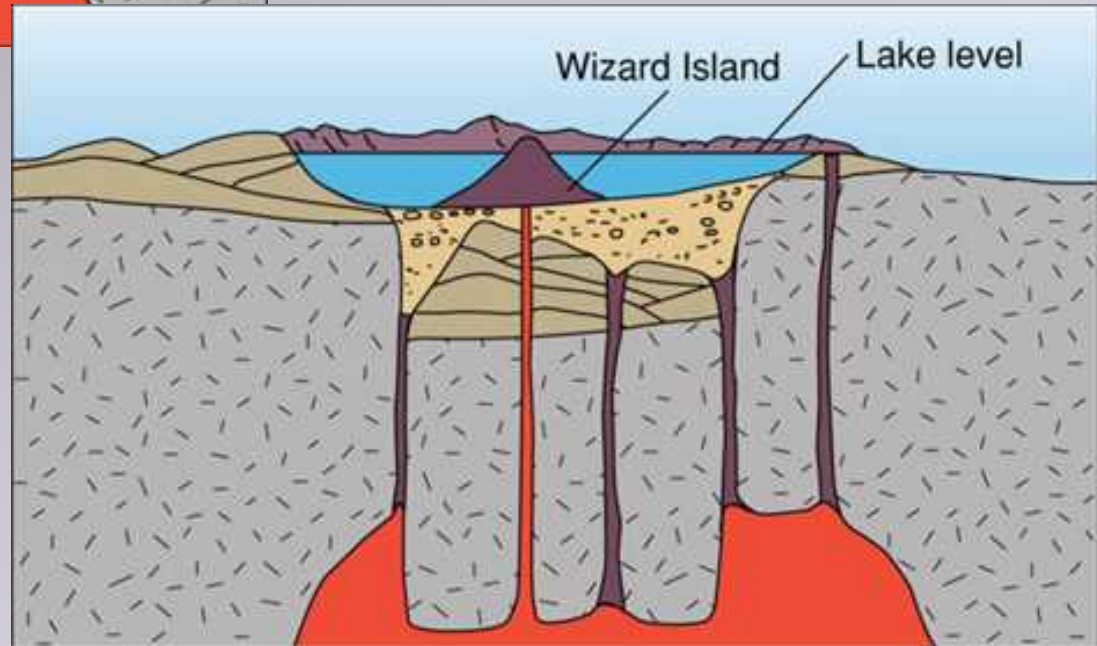
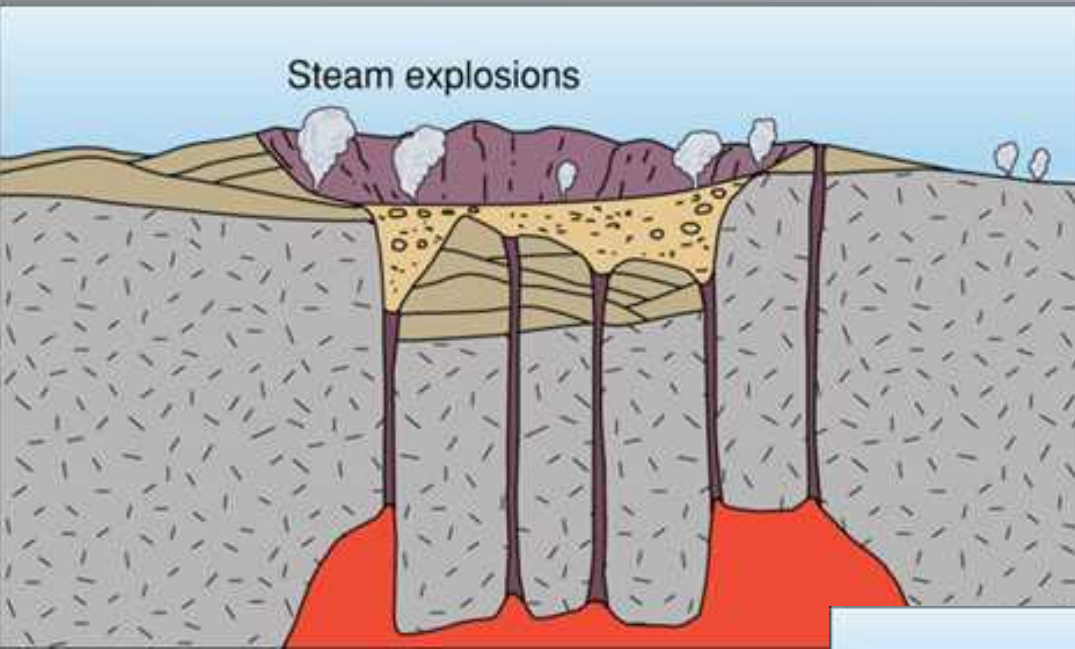
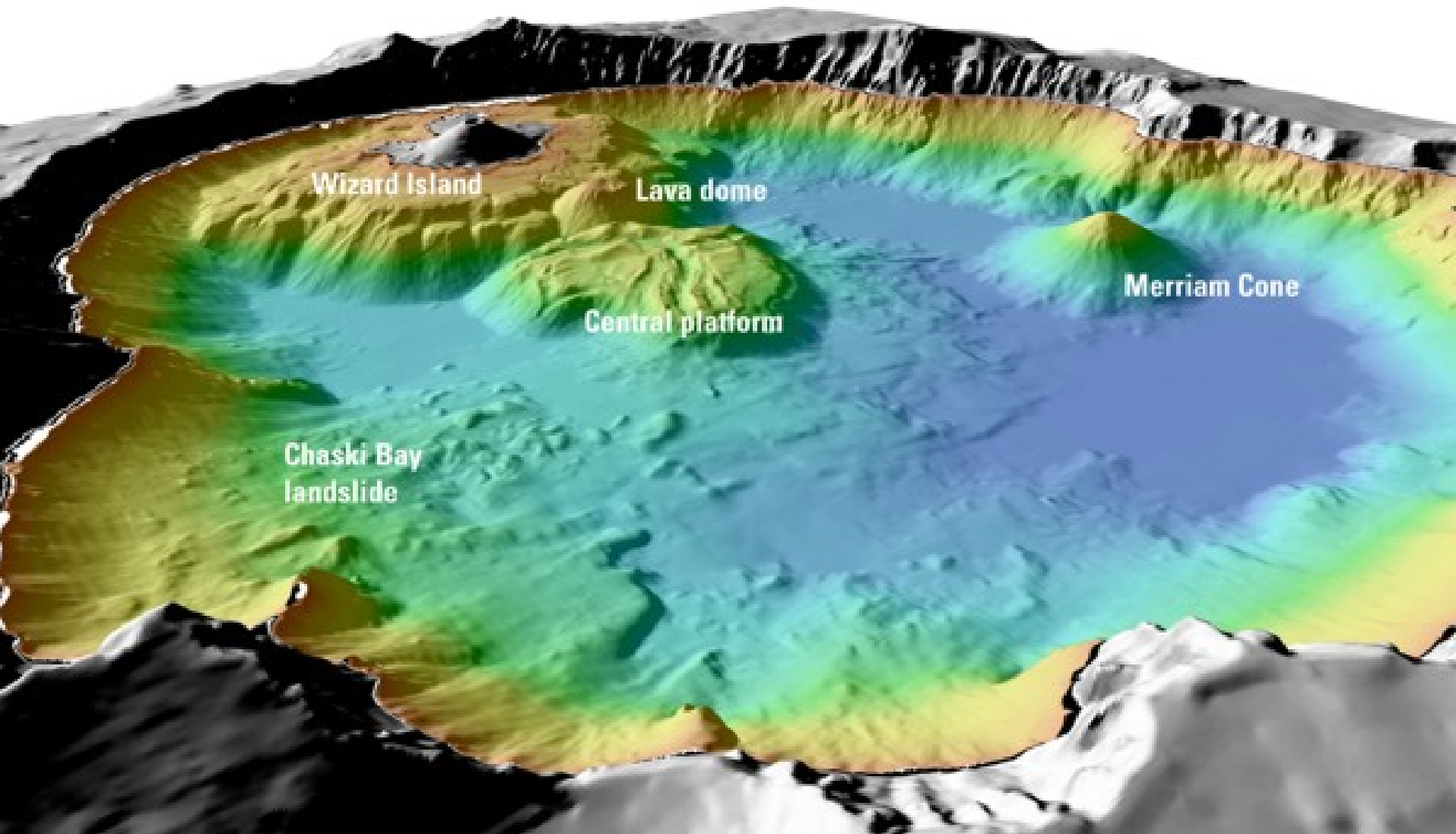


Figure 4.4

# Forming a caldera



# Crater Lake perspective view



# Layering in a stratovolcano

Rim of Crater Lake





# Cinder cone



# Cinder cone erupting



# Cinder cone with a collapsed crater



# Cinder cone slope



# Shield volcano – produced by basalt flows

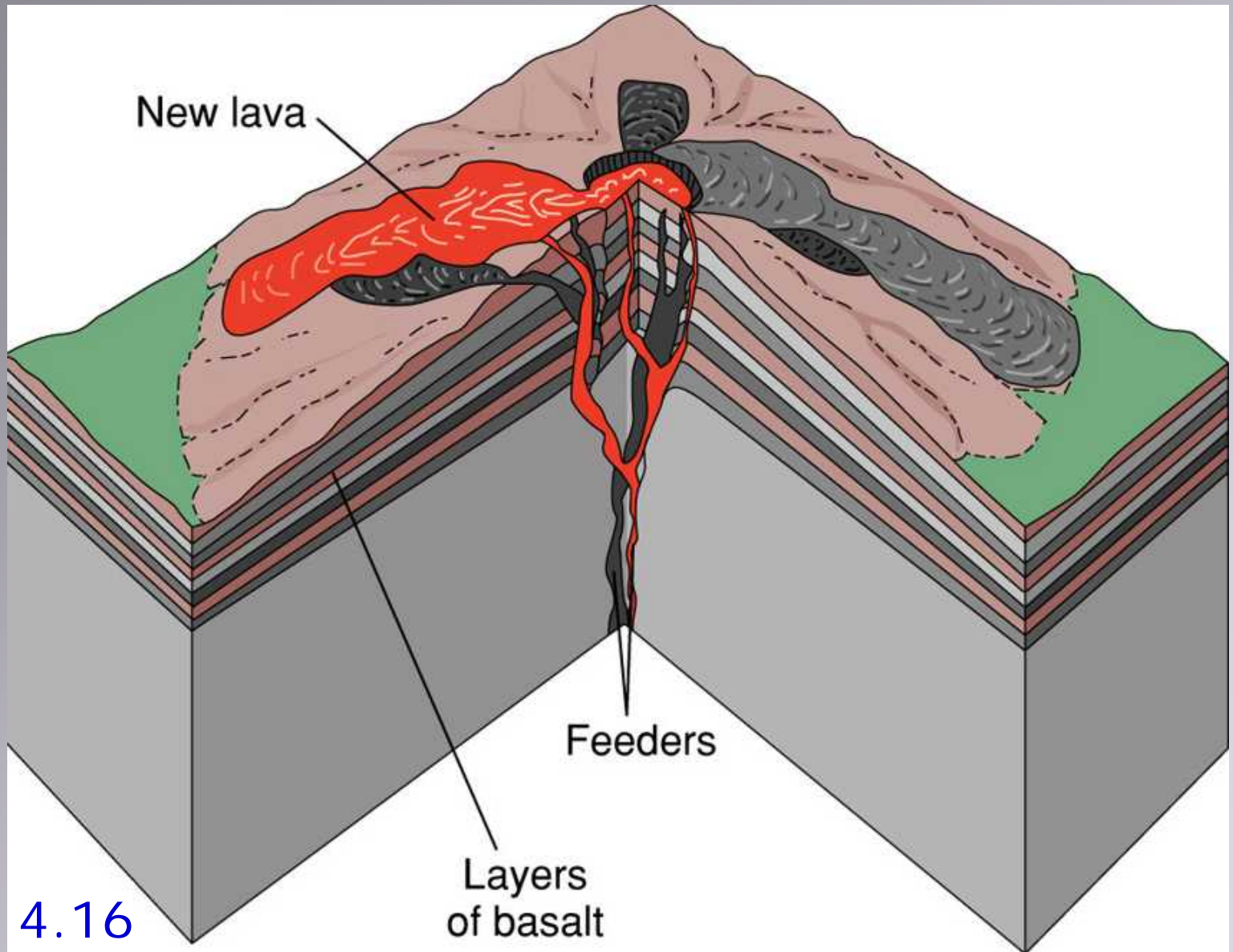
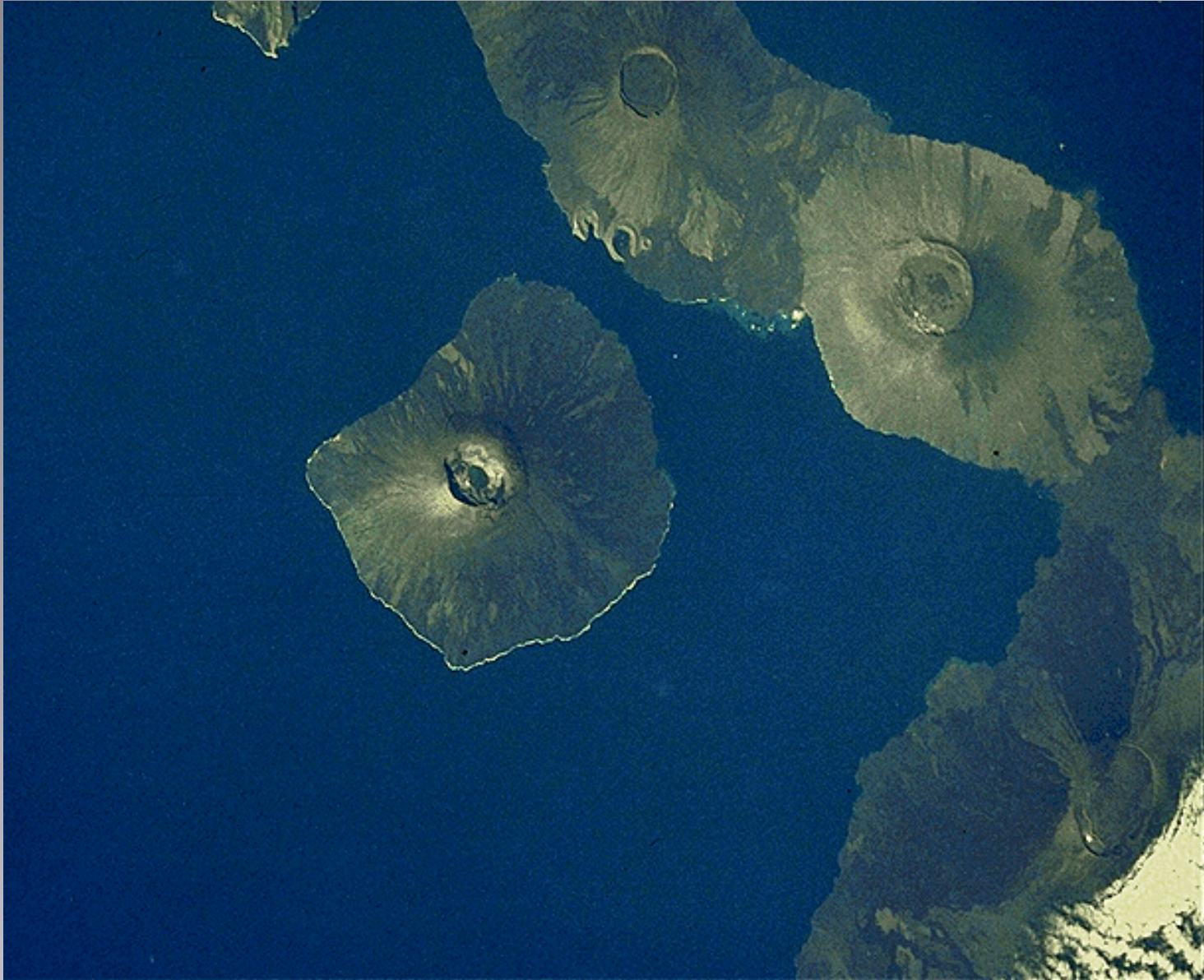


Figure 4.16

# Shield volcanoes – Galapagos Islands



# Galapagos Islands

Low-relief slopes

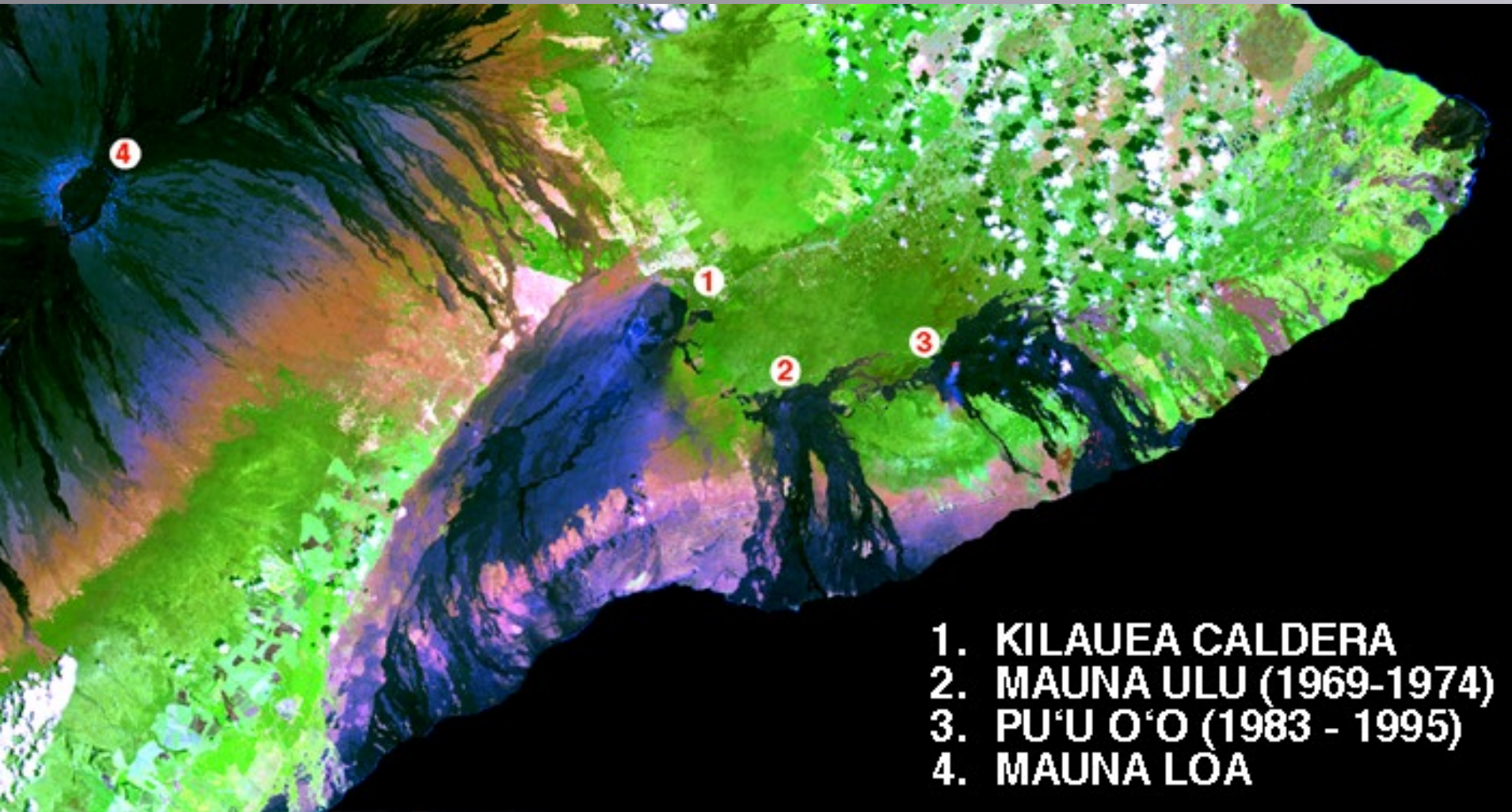


# Hawaii – Mauna Loa and Mauna Kea

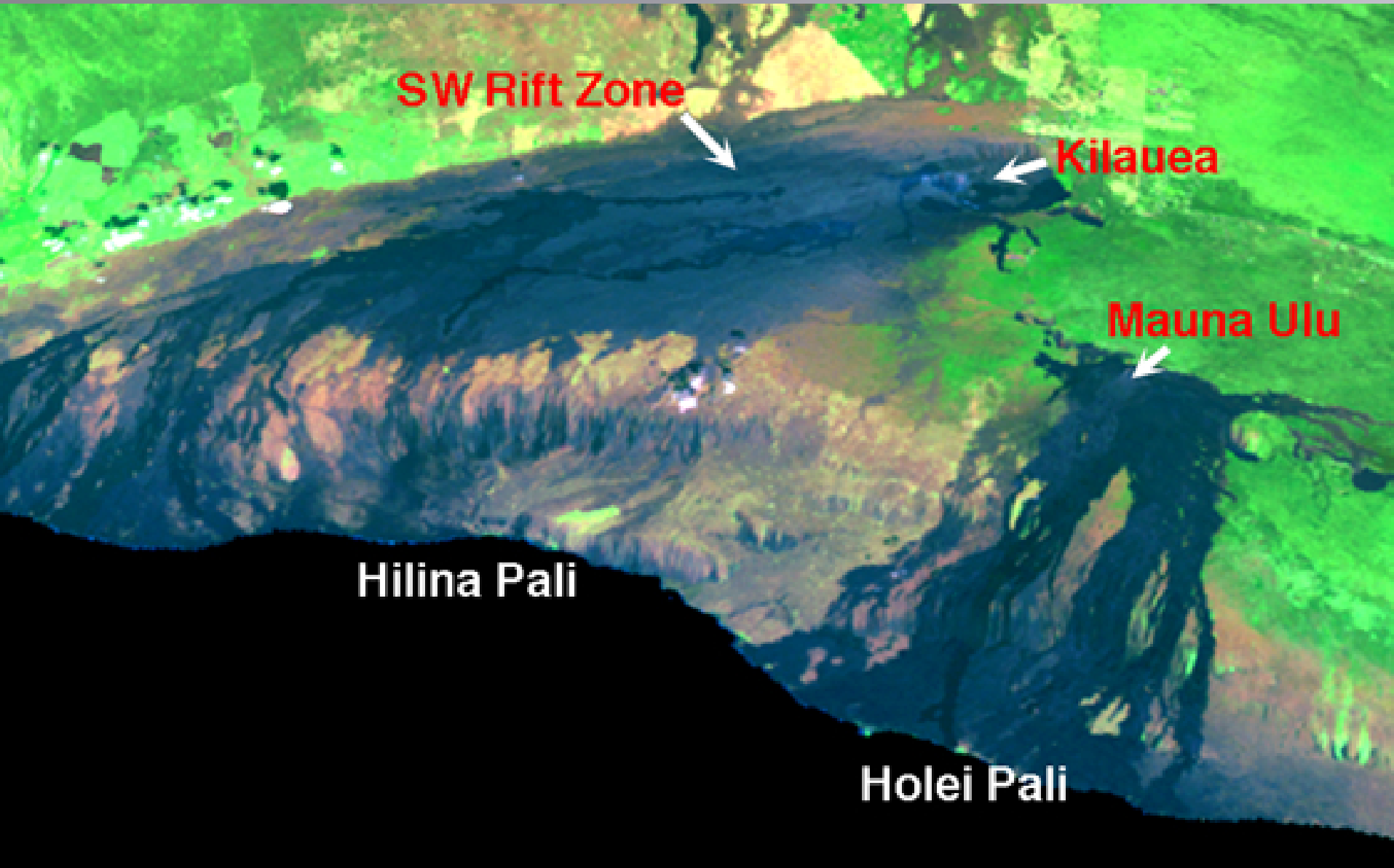




# Active volcanoes



# Southwest rift lava flows





Pu'u O'o



# Basaltic lava – Pahoehoe (ropy texture)

“Pah hoy hoy”



Basaltic lava – aa partially cooled  
“ah-ah”



# Crater and lava pool

## Spattercone

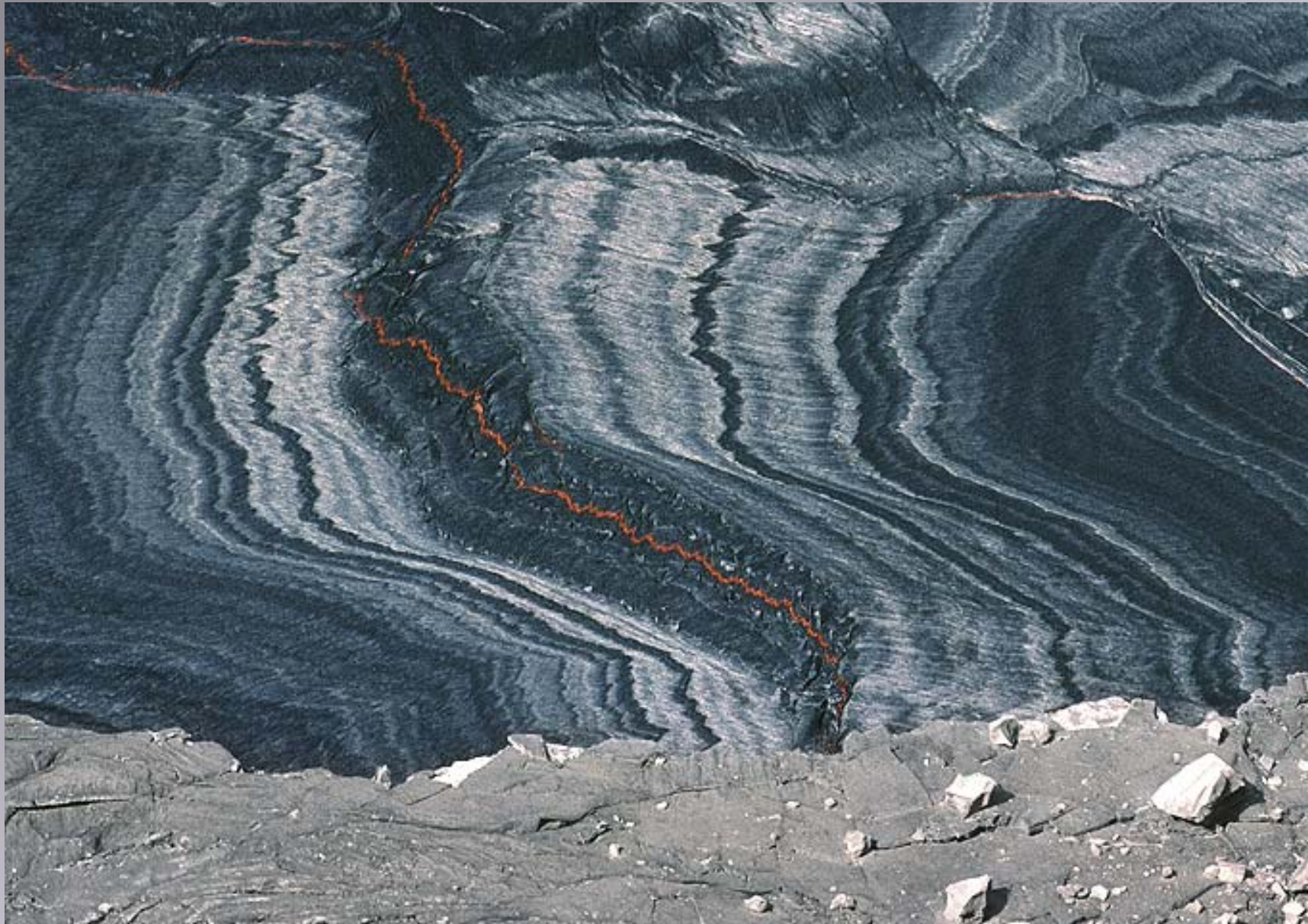


## Firefountain

# Lava pool tectonics – a “rifting zone”



# Lava pool tectonics





# Lava pool tectonics – a “triple junction”



# Lava tube

Flowing lava drains out of cooled outer tube





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Lava  
tube  
New Mexico



# Basalt – columnar jointing

Figure 4.28



# Basalt – columnar jointing

Figure 4.28

Note: based on triple junctions ( $120^\circ$  angles)



# Devil's Tower



# Giant's causeway, Ireland

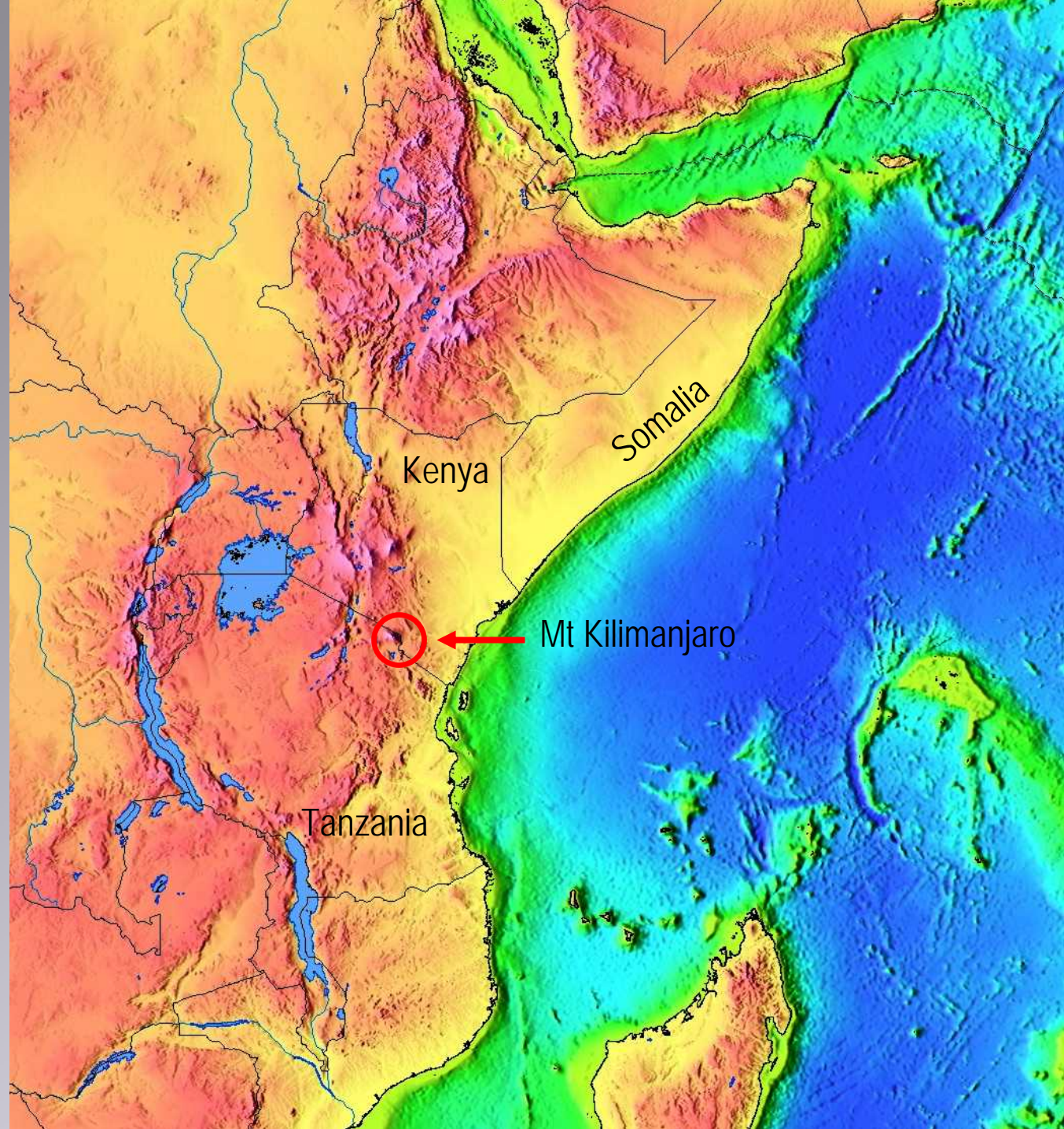






# East African Rift Valley

Breaking apart the continent



# Extensional Faulting in the Afar Rift



# East African Rift





# Mt Kilimanjaro

Snow field 1993

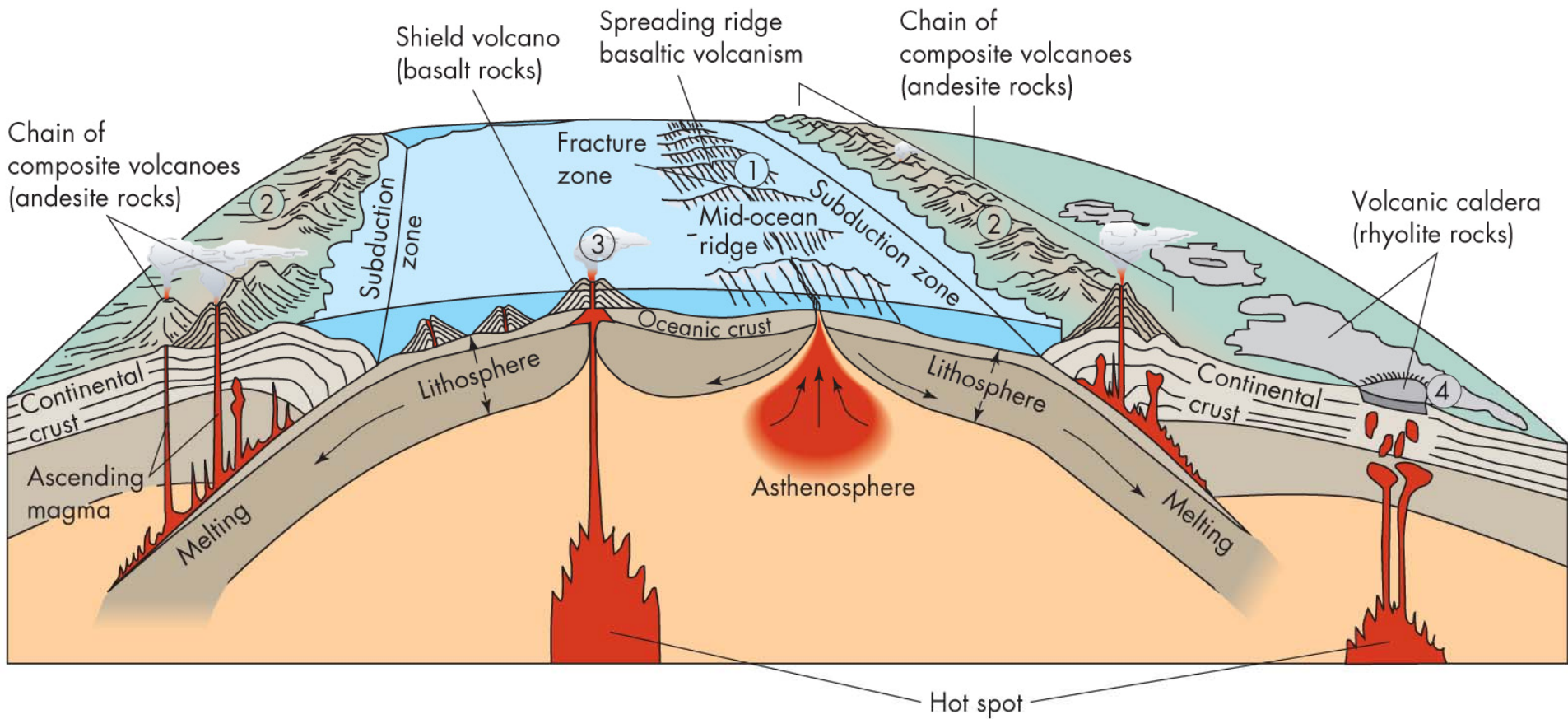


2000





# Tectonic settings for volcanoes



Subduction zones

Mid-ocean ridge

Hot spots

Continental rifting

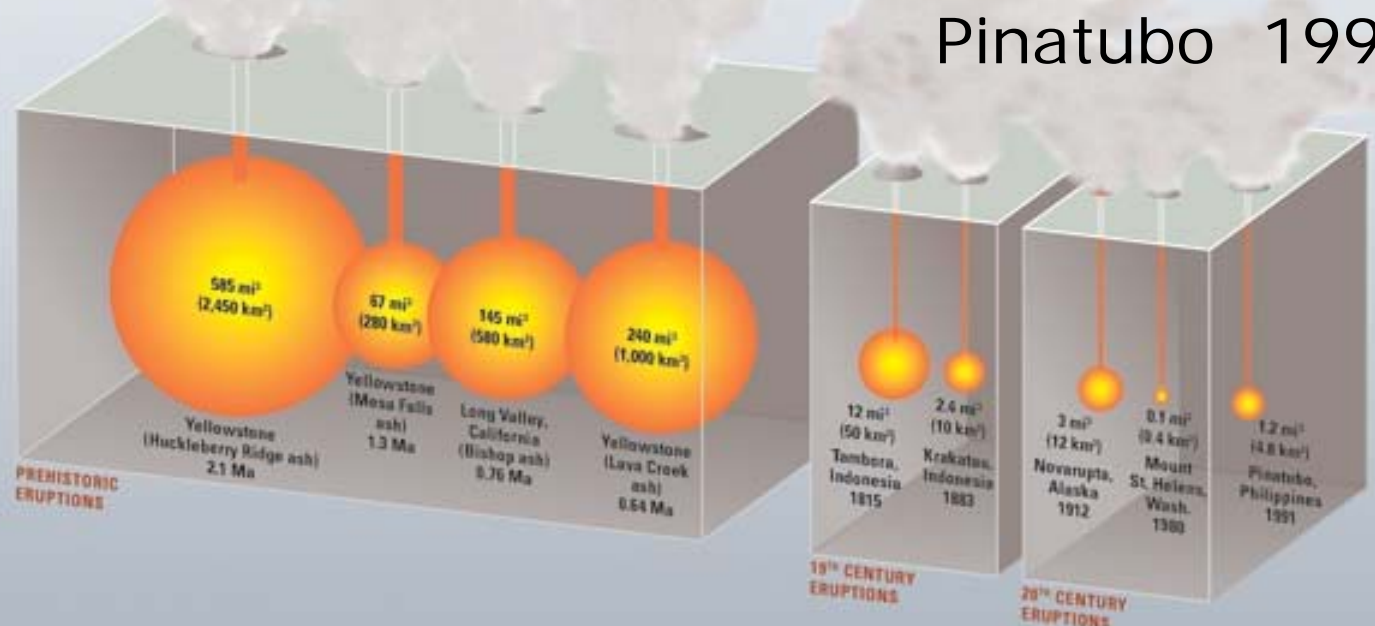


# Largest eruptions by volume

Yellowstone 2.1 Ma  
Yellowstone 1.3 Ma  
Long Valley 760 ka  
Yellowstone 640 ka

Tambora 1815  
Krakatau 1883

Alaska 1912  
St Helens 1980  
Pinatubo 1991

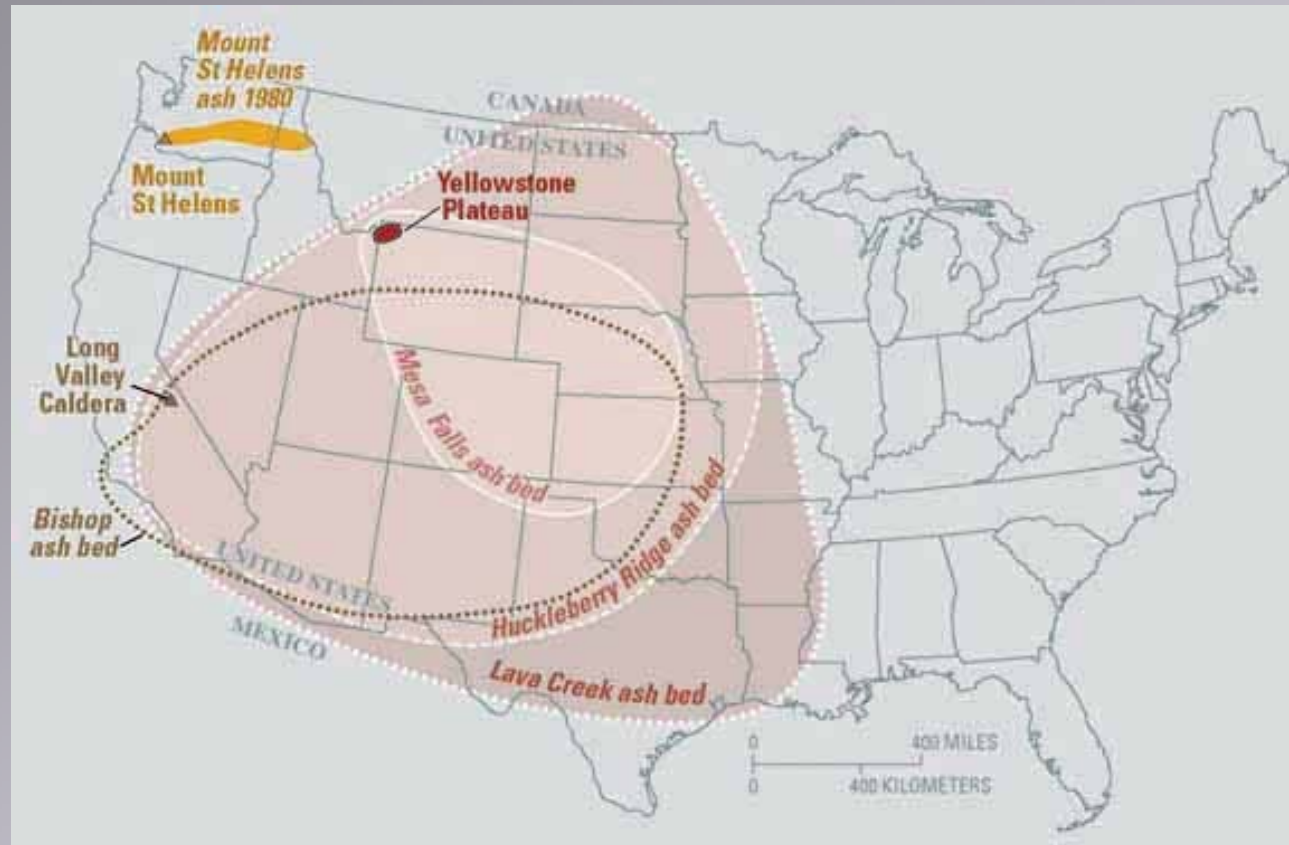


# Largest eruptions on North America

Yellowstone  
2 largest

Long Valley  
3<sup>rd</sup> largest

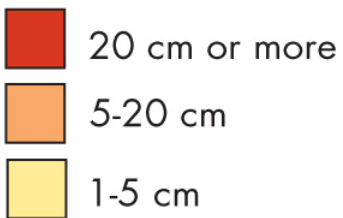
Compare with  
Mt St Helens





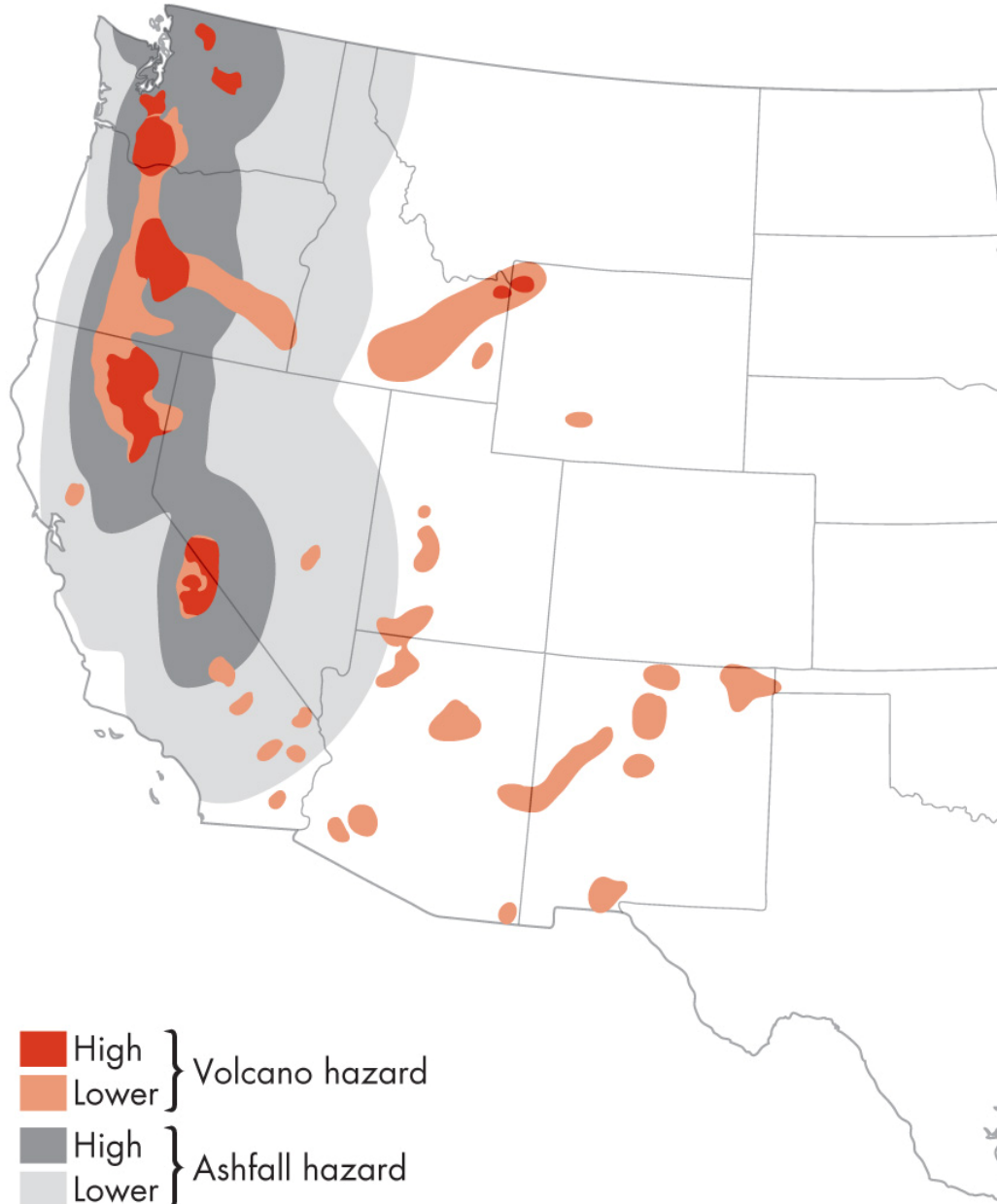


### Thickness of Airfall Ash



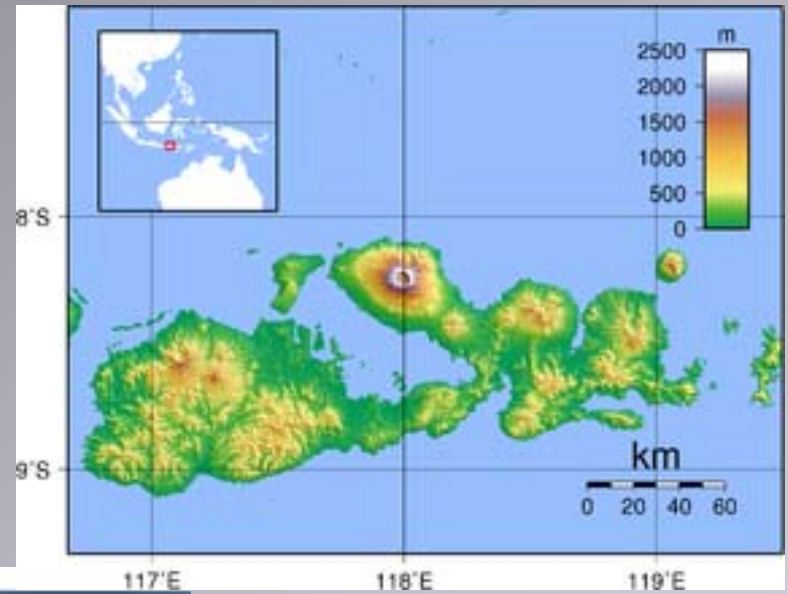
# Volcanic Hazards:

(Based on activity in the last 15,000 years)

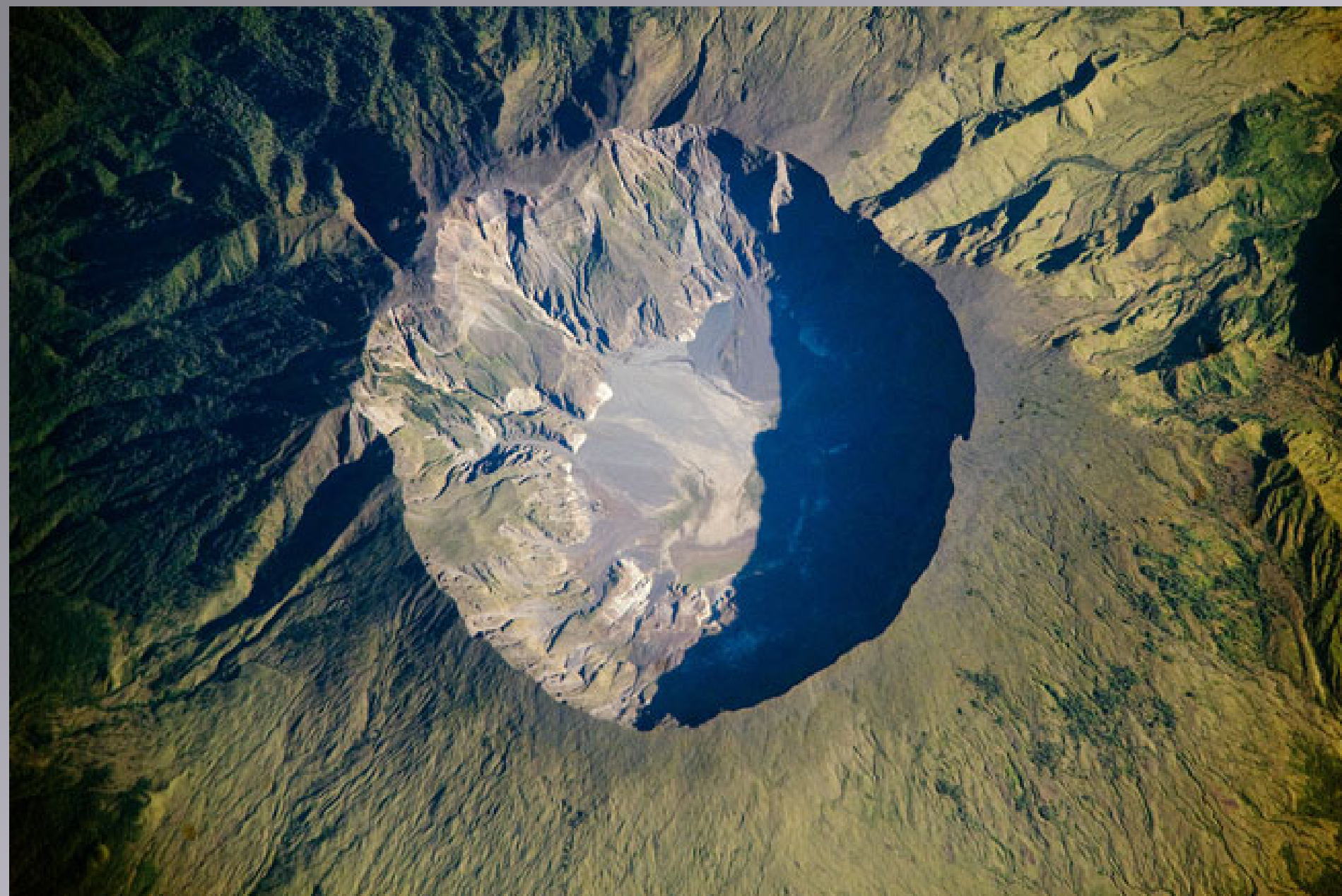


- High } Volcano hazard
- Lower } Volcano hazard
- High } Ashfall hazard
- Lower } Ashfall hazard

# Tambora, Indonesia



# Tambora, Indonesia



# Tambora, Indonesia





# The year without summer, 1816



Painting by Turner