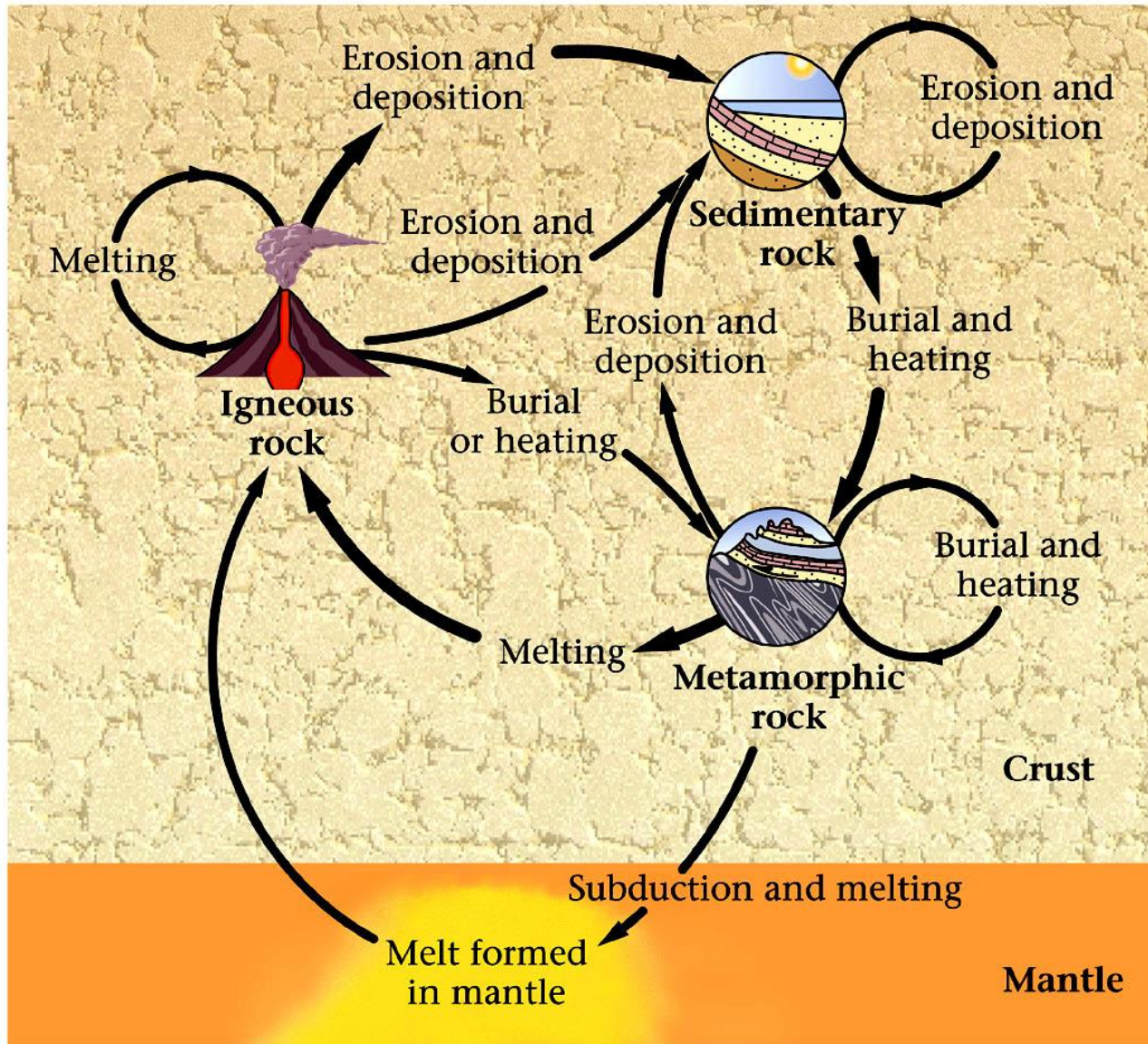


The Rock Cycle



Basaltic lava flow, Hawaii



School bus caught by basaltic flow, Hawaii



Pahoehoe or ropy lava



Blocky lava flow, Hawaii



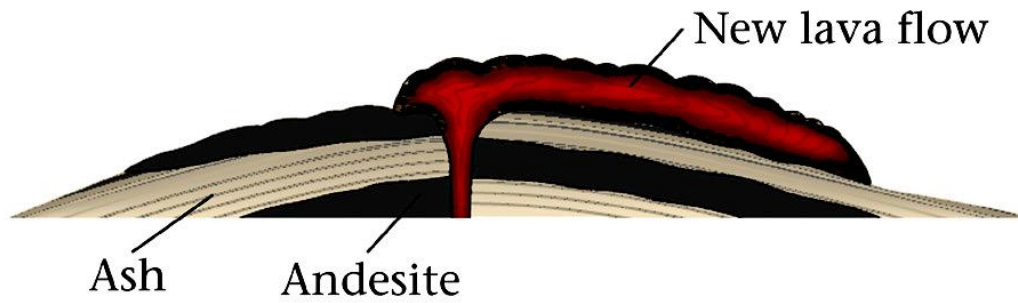
Aa or blocky lava



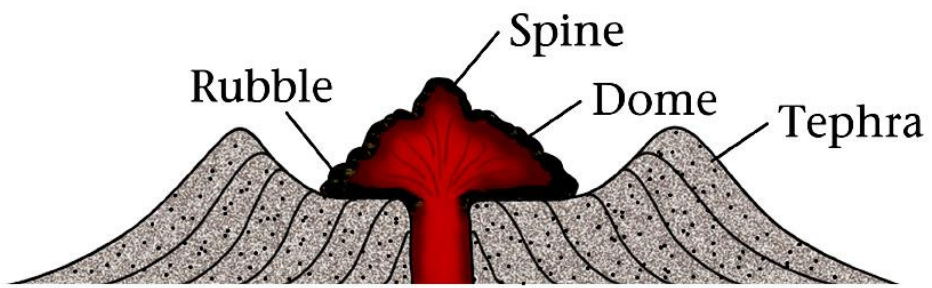
Magma viscosity and volcanic behaviour



(a)



(b)



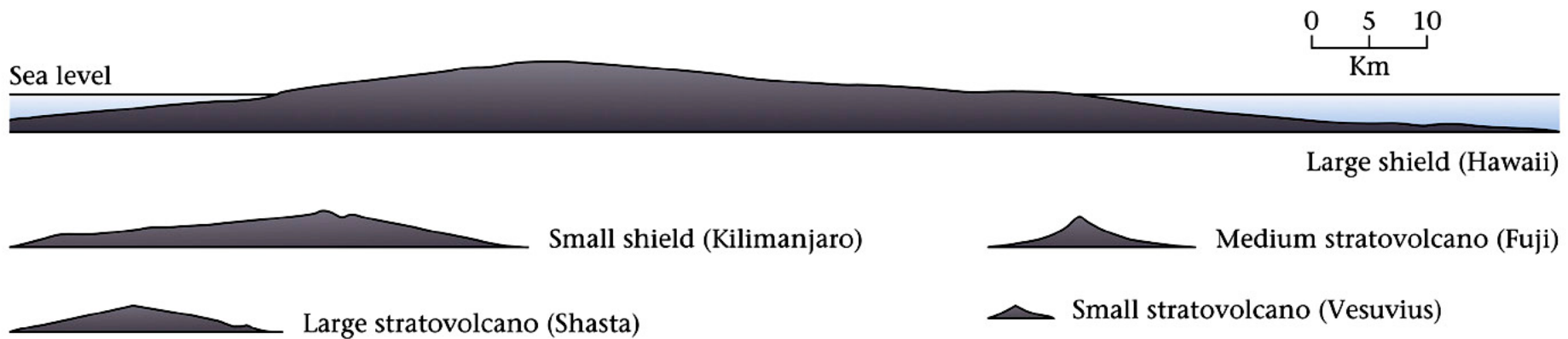
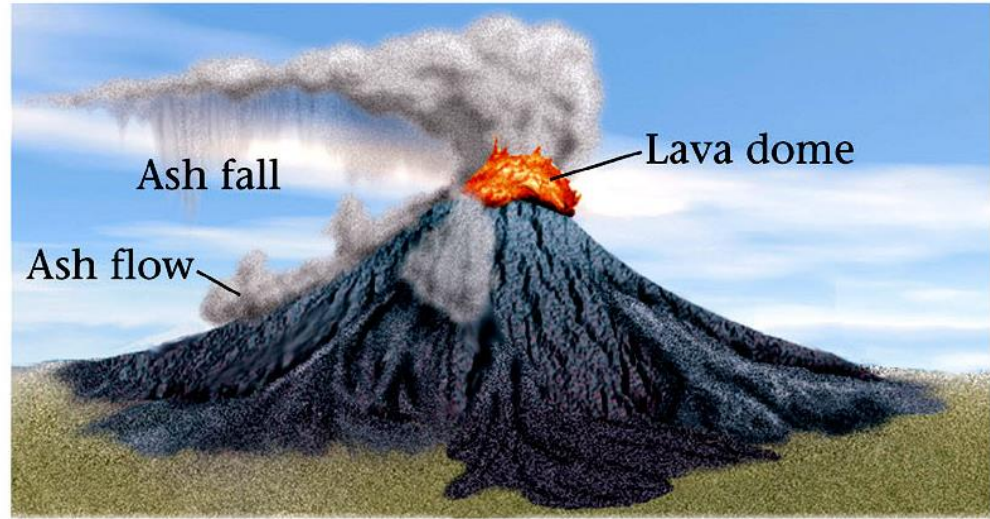
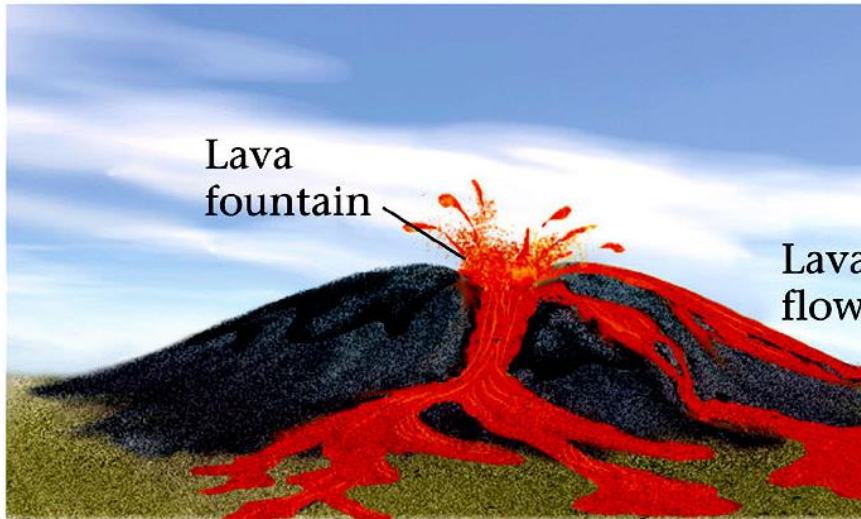
Rhyolitic dome

(c)

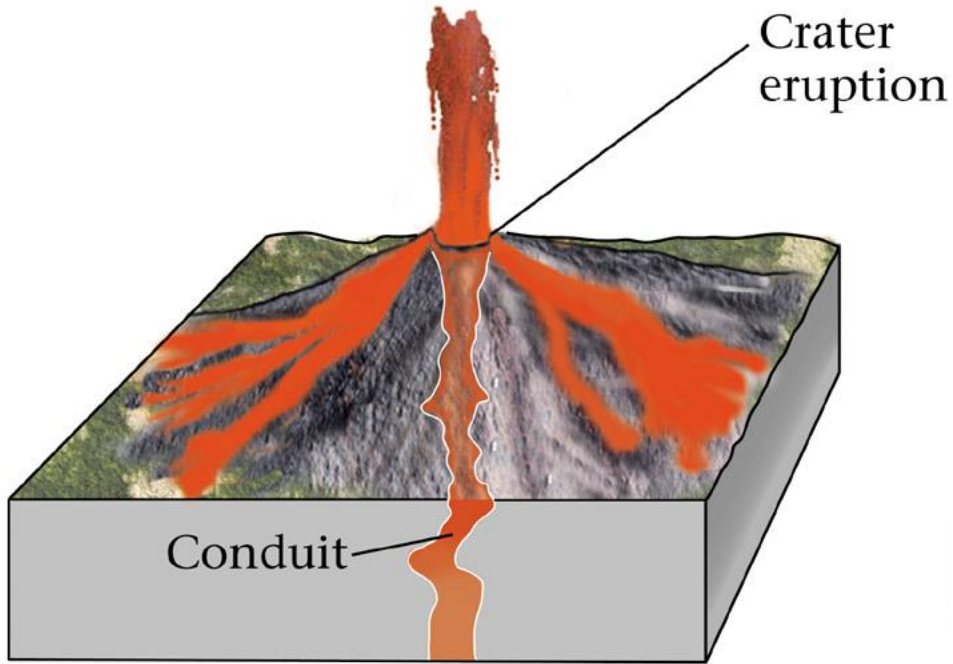
Volcano types

Shield volcano

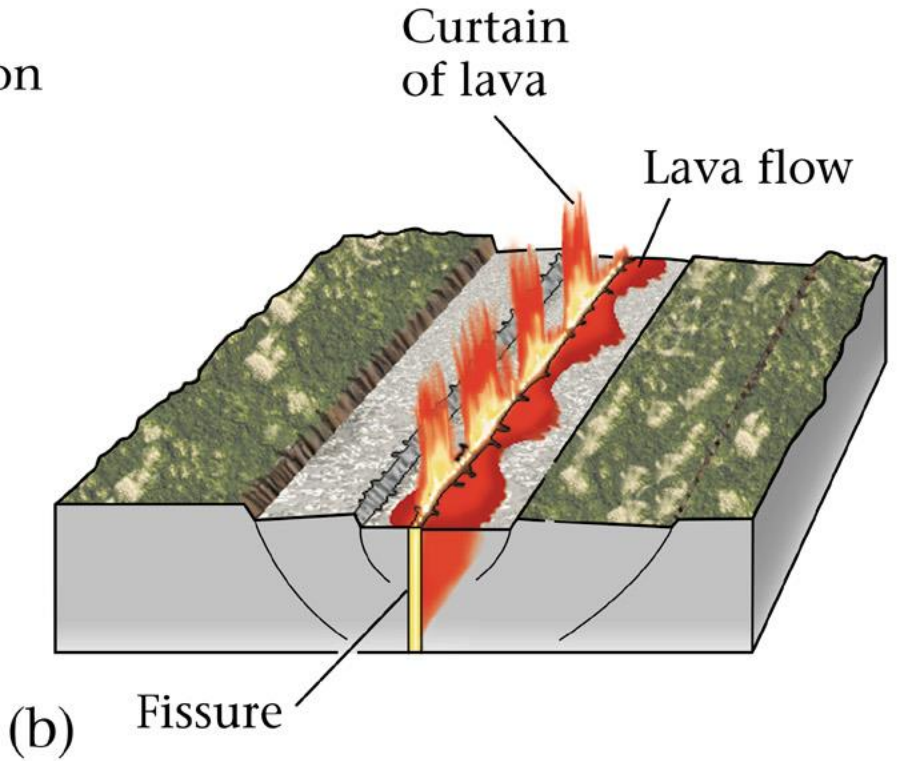
Stratovolcano



Shield volcano eruption



(a)



(b)

Shield volcano eruption, Piton de la Fournaise, Reunion

Lava fountain

Sampling lava



Volcanoes and Plate Tectonics

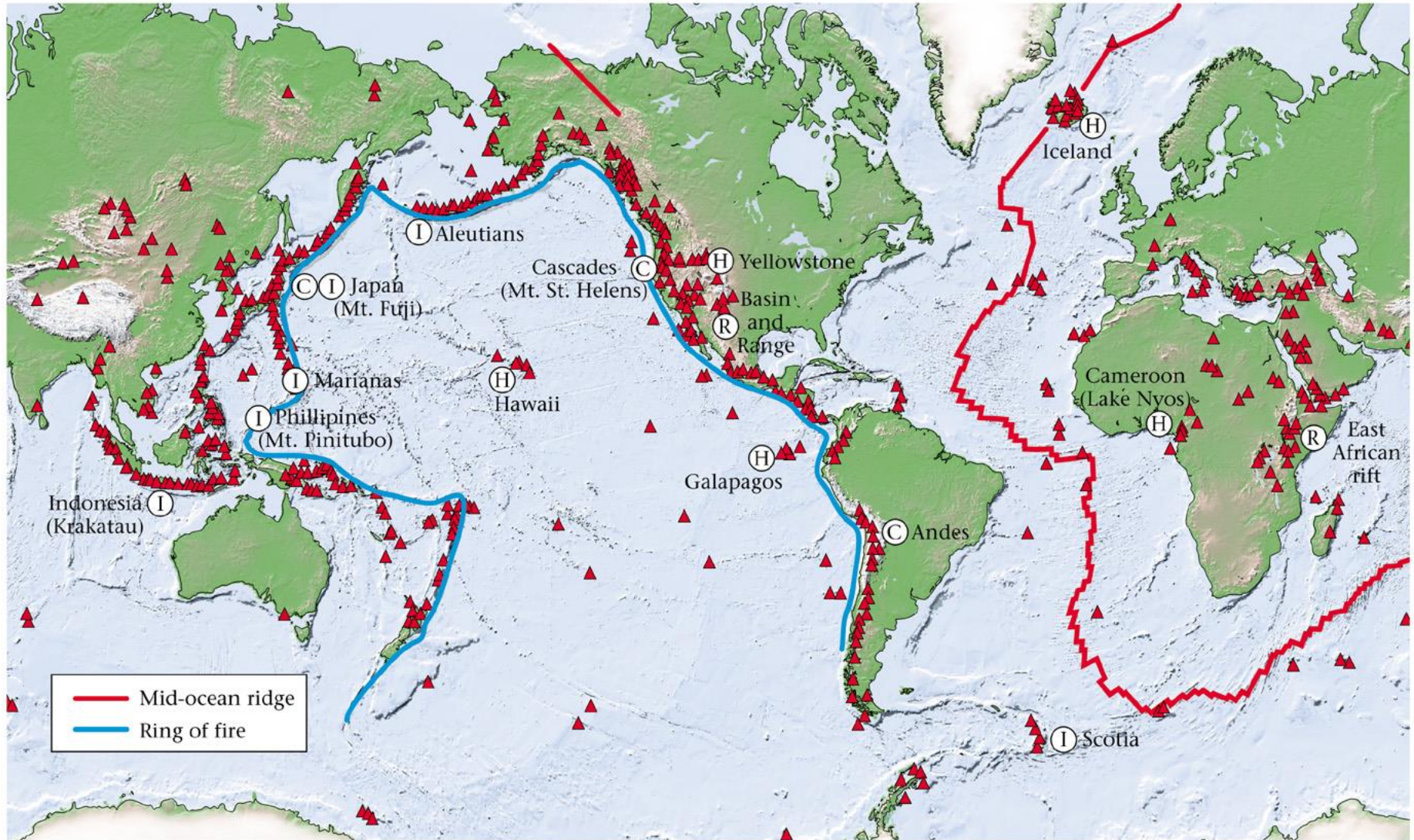
Ⓘ = Island arc

Ⓒ = Continental arc

Ⓓ = Rift

Ⓗ = Hot spot

Ⓜ = Mid-ocean ridge



Rift Volcanoes – and Ol Doinyo Lengai

World's only active natrocarbonatite (Na_2CO_3 , K_2CO_3) volcano

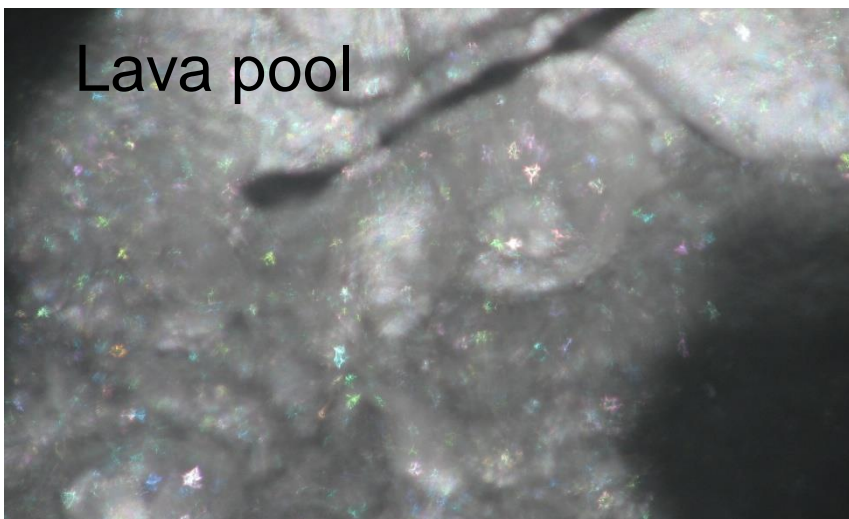
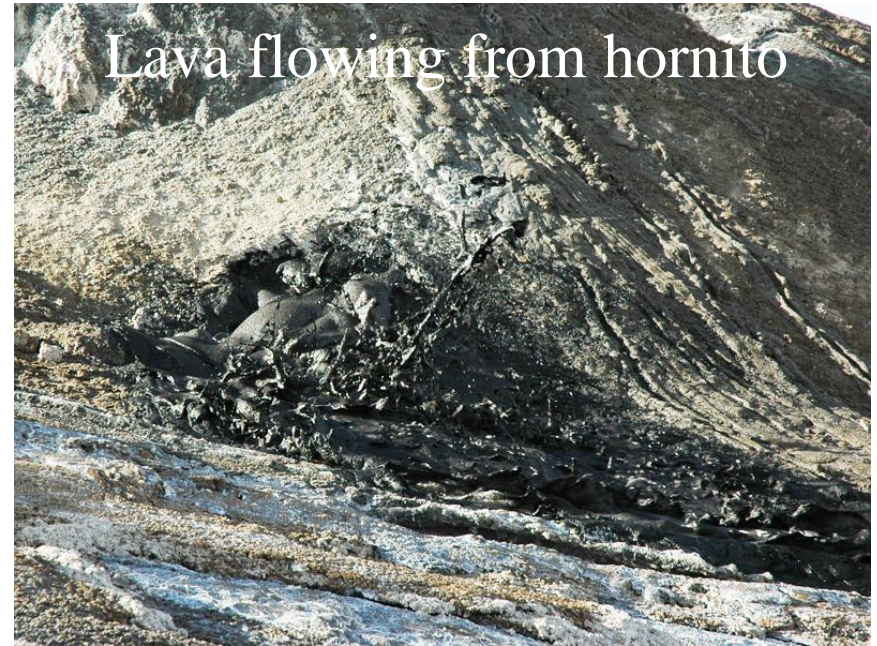


Hornitos – windows
on the lava pool



Pahoehoe lava

Natrocarbonatite (Na_2CO_3 , K_2CO_3) lava



Volcanoes and Plate Tectonics

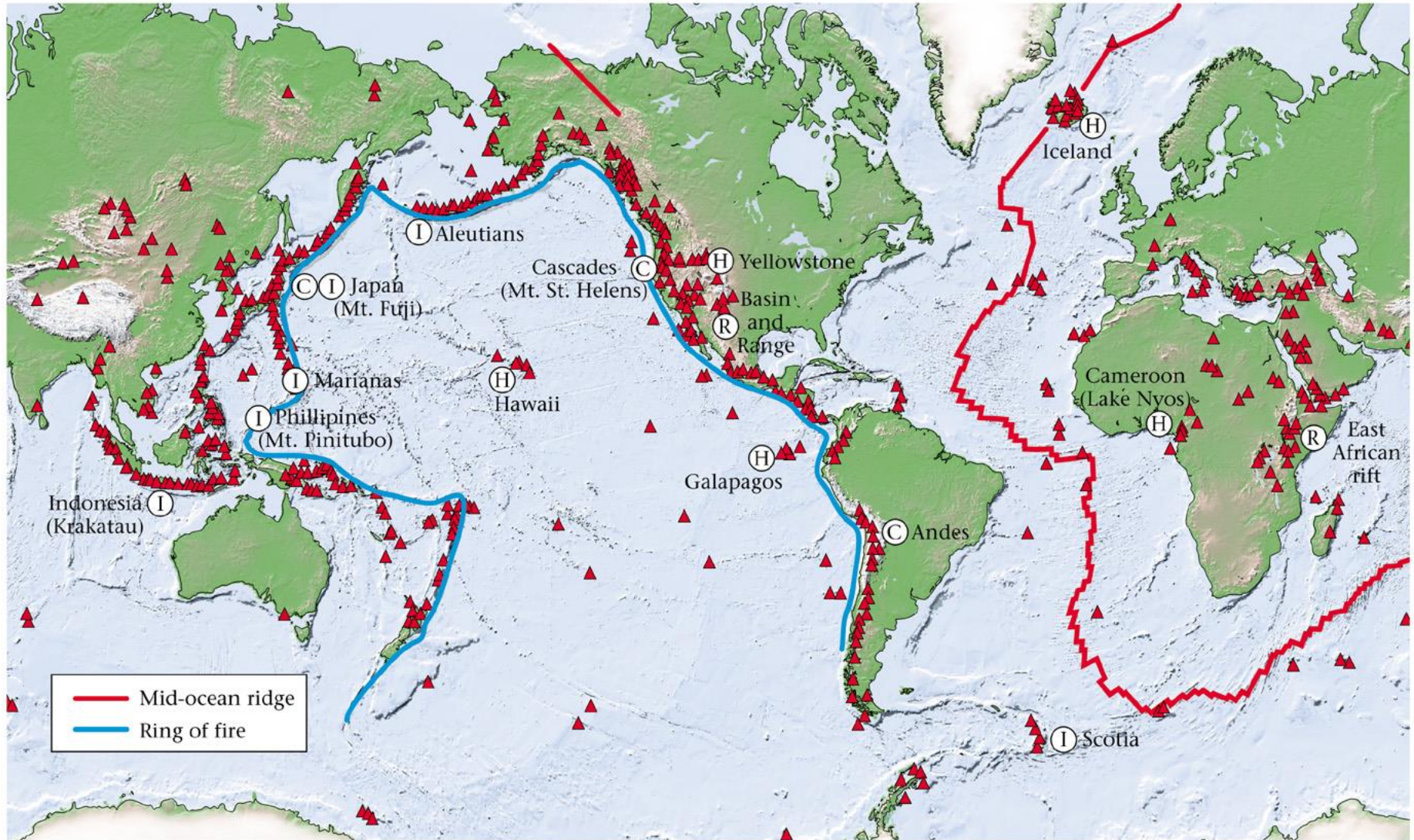
Ⓘ = Island arc

Ⓒ = Continental arc

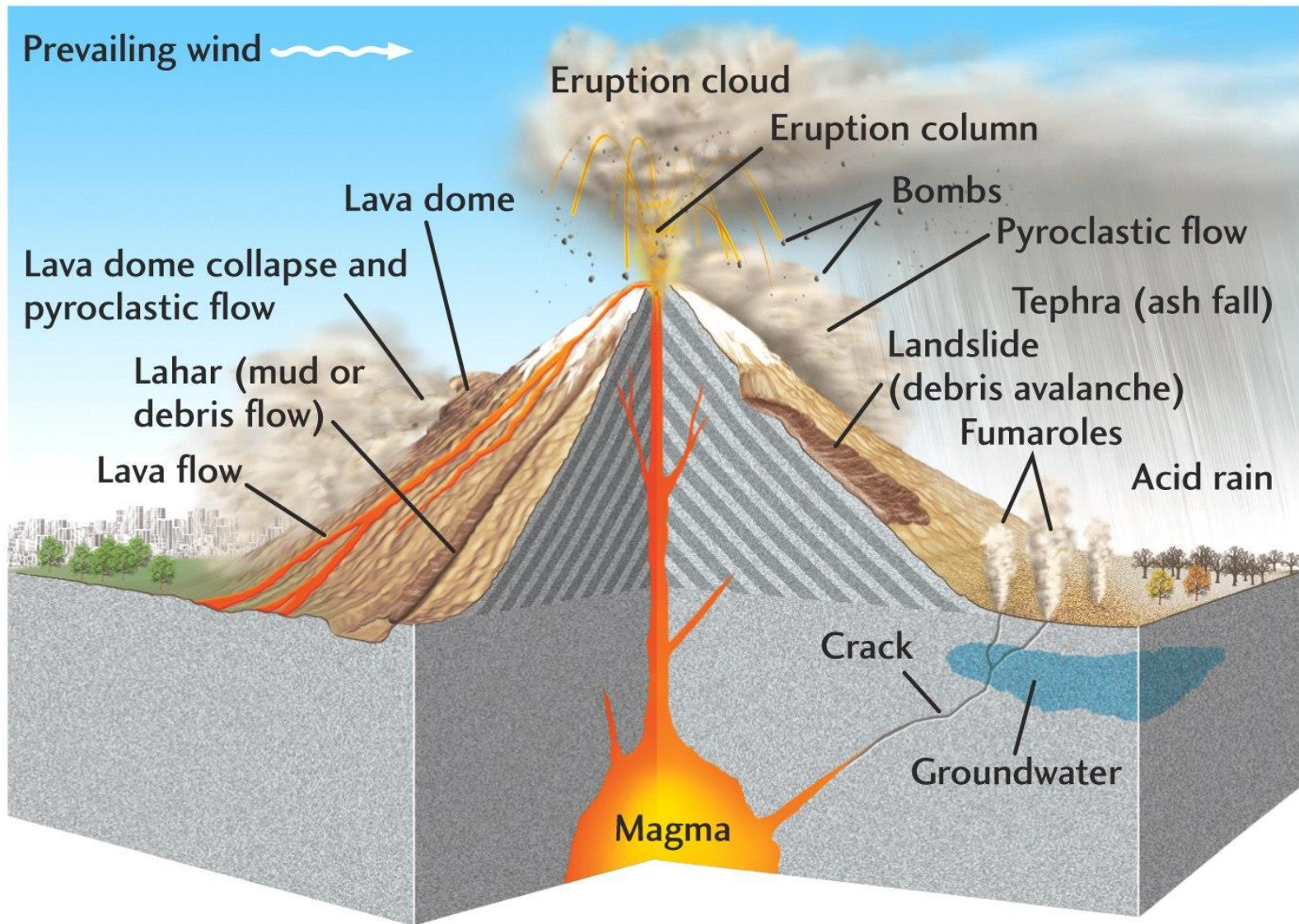
Ⓓ = Rift

Ⓗ = Hot spot

Ⓜ = Mid-ocean ridge



Stratovolcano



Classic stratovolcano - Mt Fuji, Japan



Stratovolcano eruptions

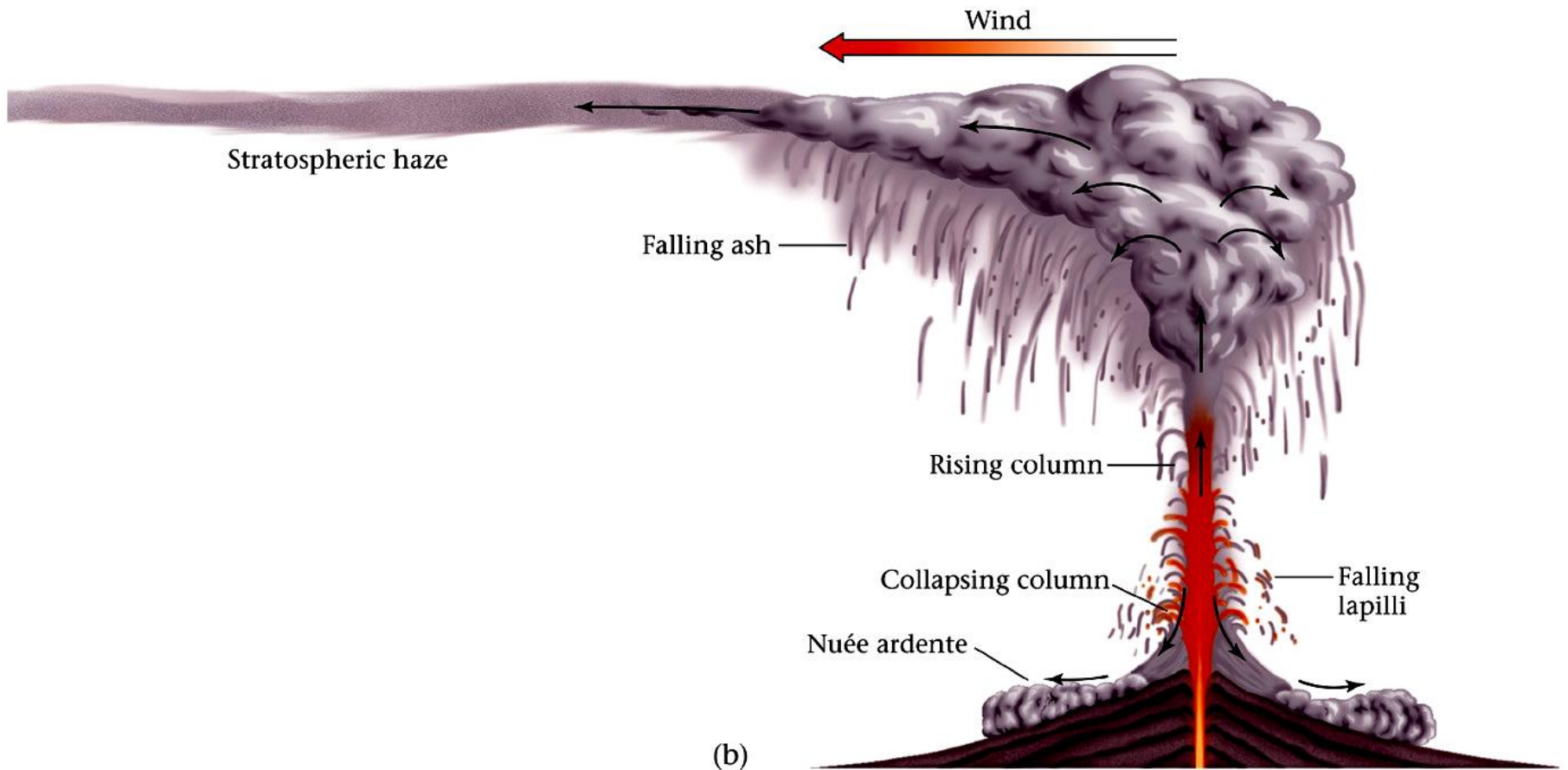
Pinchincha, Ecuador



Anak Krakatau, Indonesia

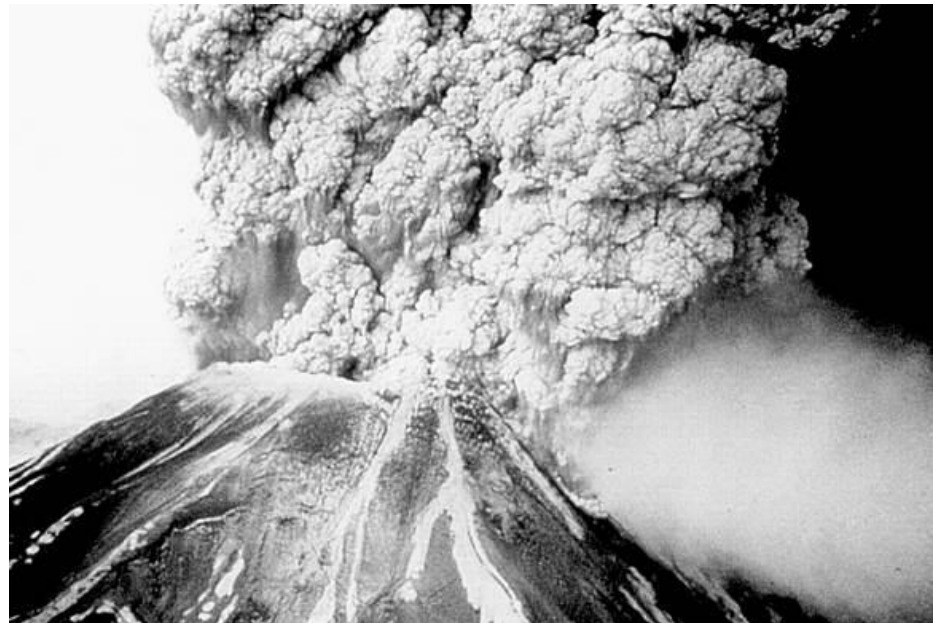
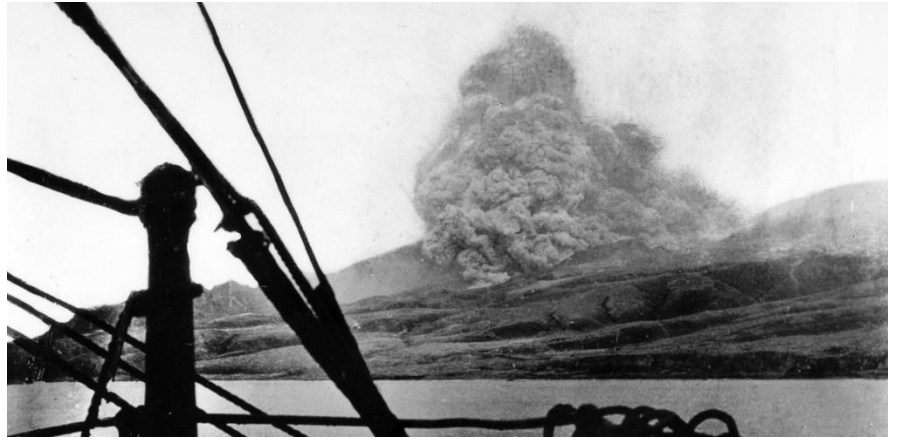


Stratovolcano eruption



The Mont Pelee 1902 eruptions

22,000 people die in
pyroclastic flows; convict
survives in dungeon

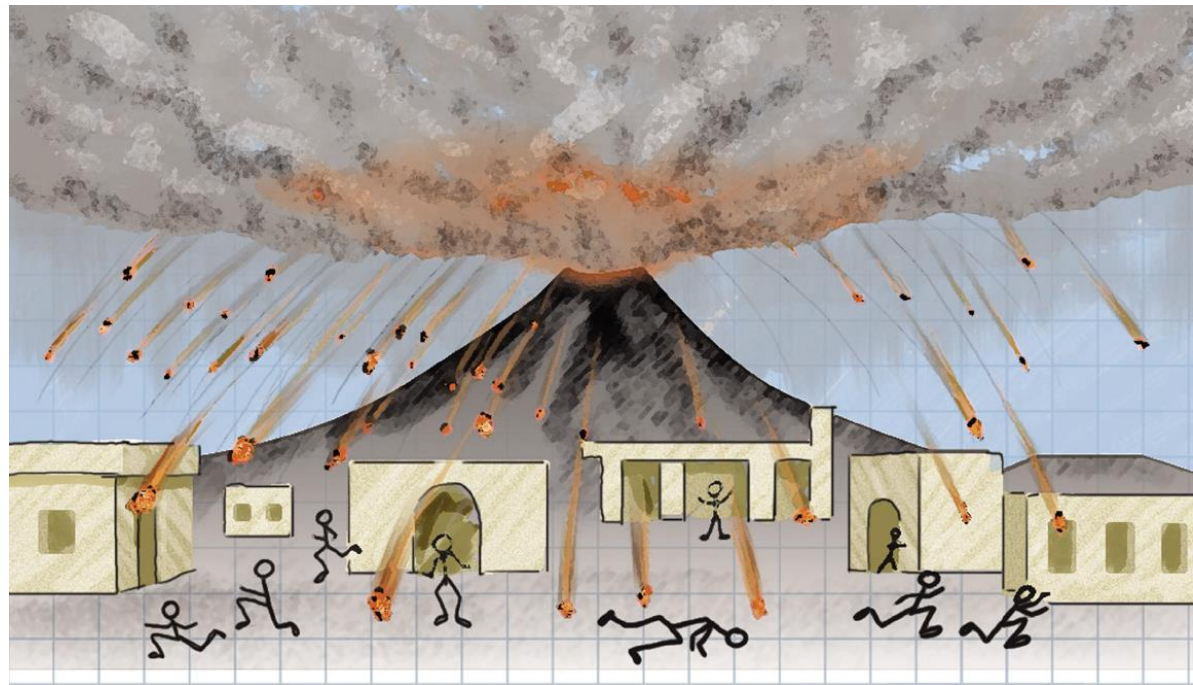
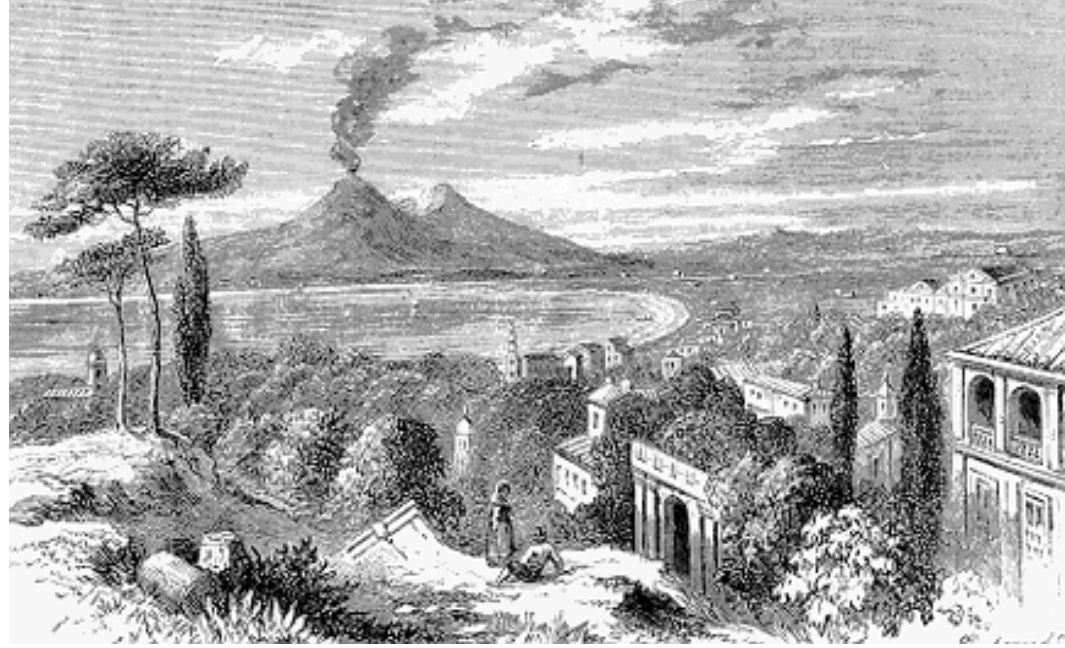


Ash fall-out from the Mt Pinatuba eruption



Vesuvius Eruption 79 AD

Destruction of Pompeii by
Bombs and Nuees Ardentes



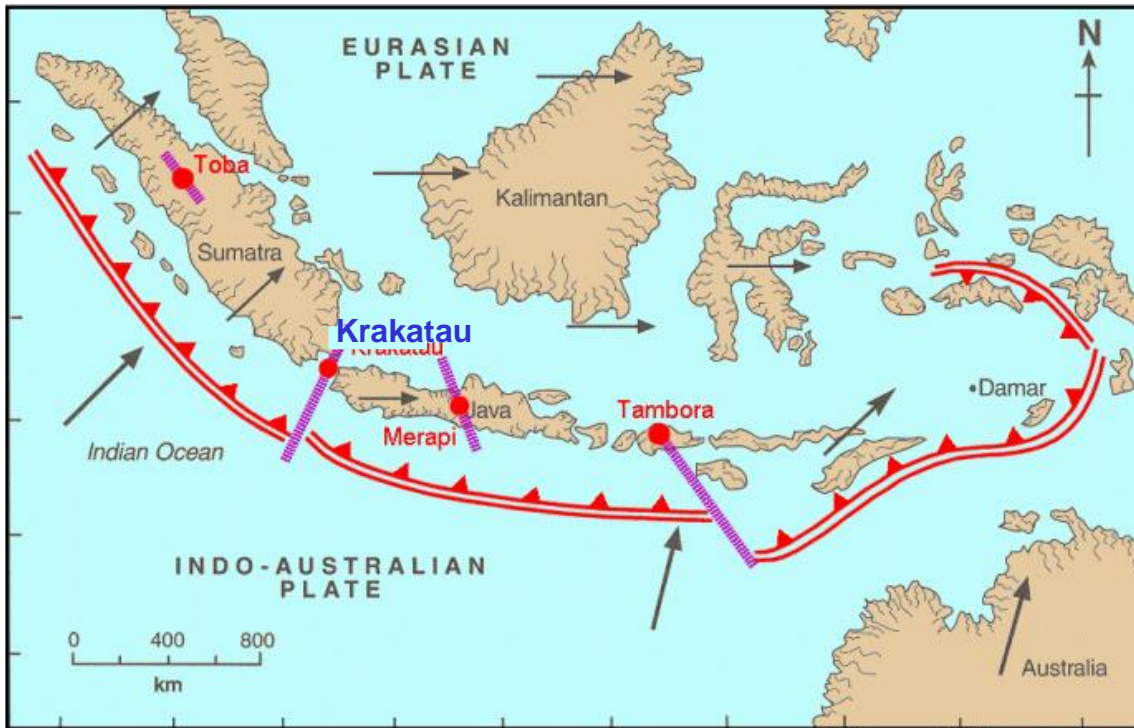


KRAKATOA
EAST OF JAVA

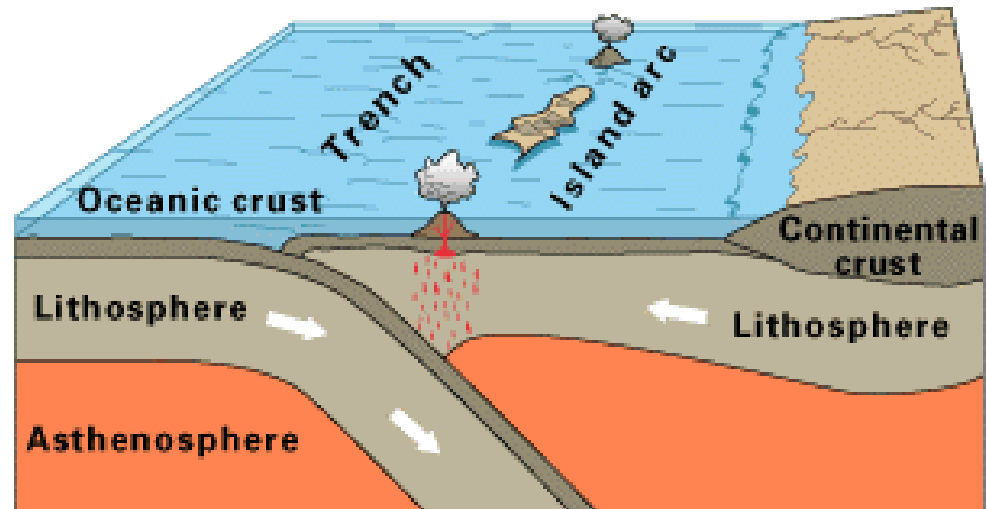
KRAKATOA
EAST OF JAVA

Indonesia

Population: 215 million
World's fourth most
populous nation. 60%
on island of Java

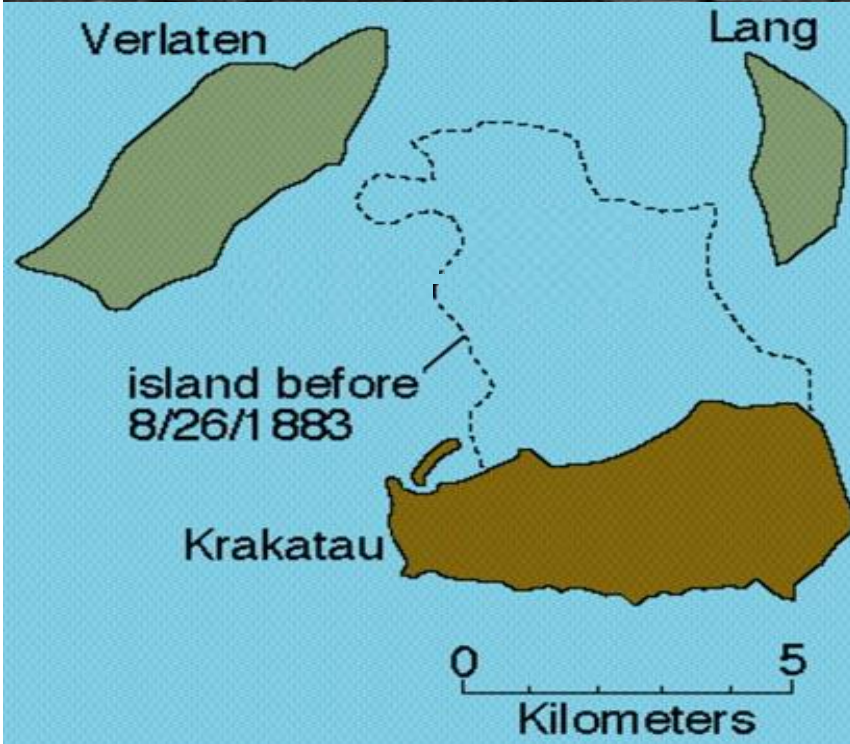
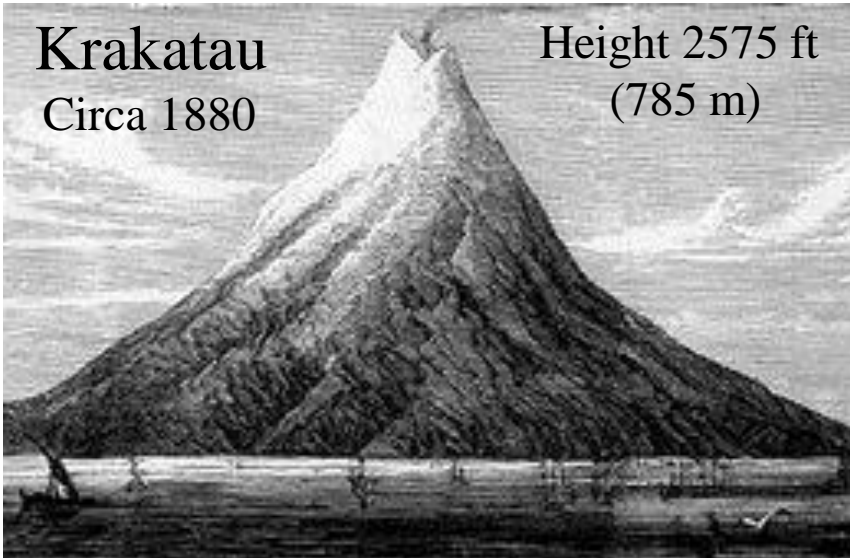


Volcanoes: 79 active
- 20% of the world
total - 600 eruptions
since 1800



Krakatau
Circa 1880

Height 2575 ft
(785 m)

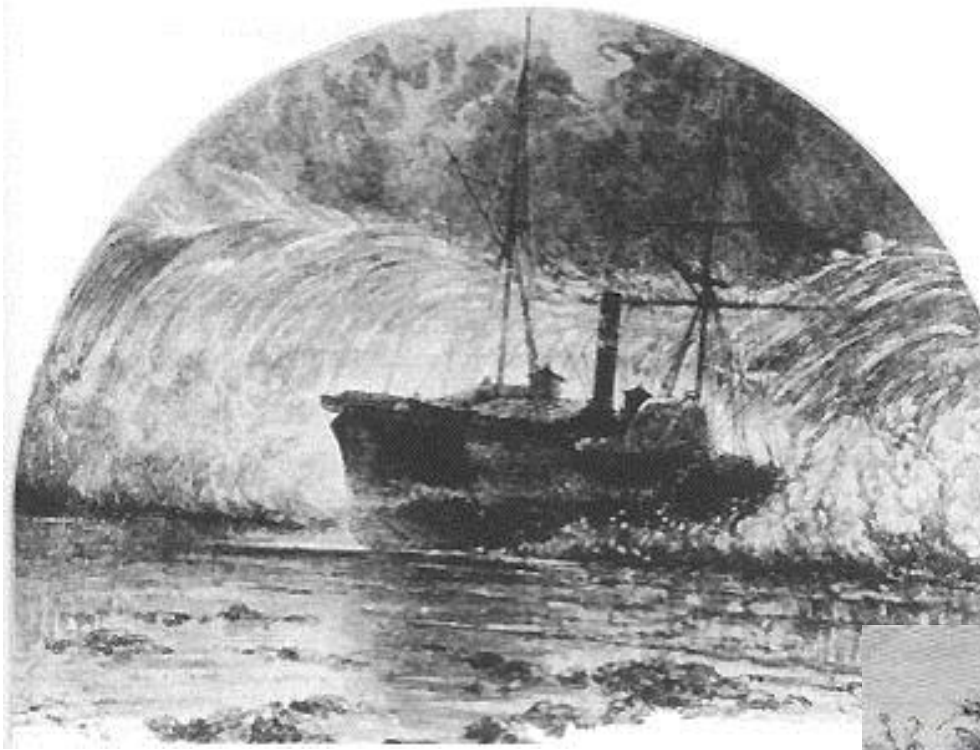


Krakatau Eruption

August 27th, 1883

- Blast 10,000x greater than at Hiroshima
- >36,000 people killed
- 18 Cubic Km material ejected





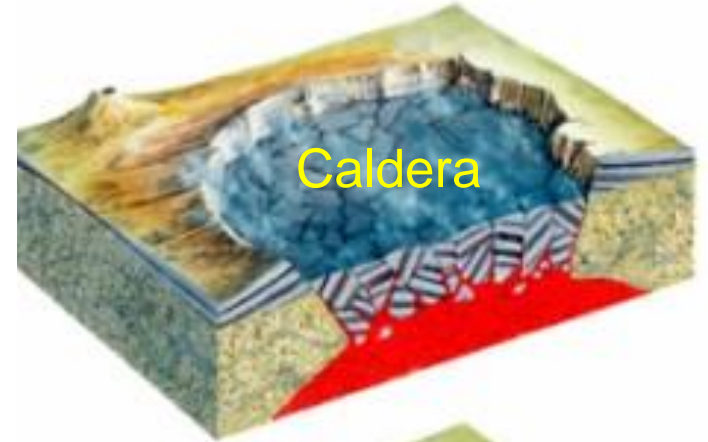
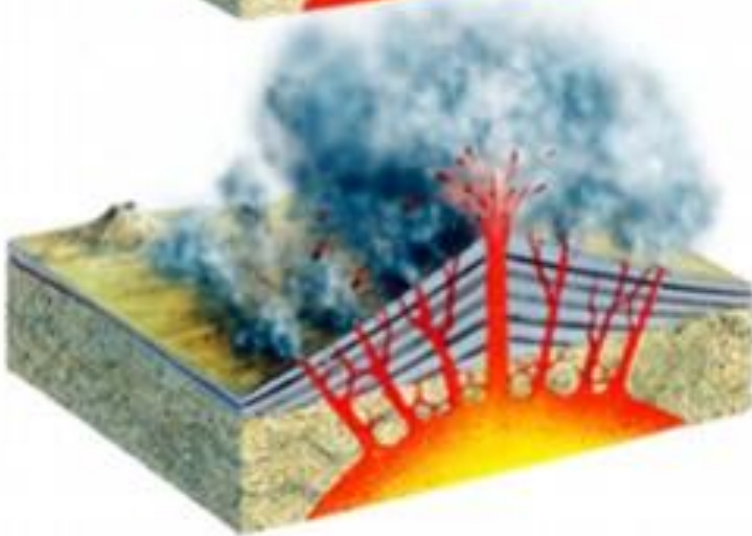
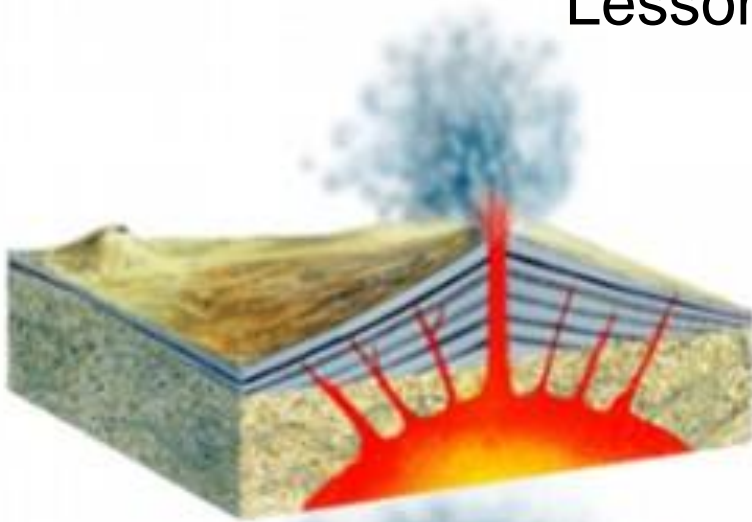
Royal Dutch Navy
paddle steamer *Berow*
carried by Krakatau
tsunamis (some up to
40 m high)

Berow stranded 3.5
km up the Koeripan
river, 18.5 m above
sea level



The death of a volcano

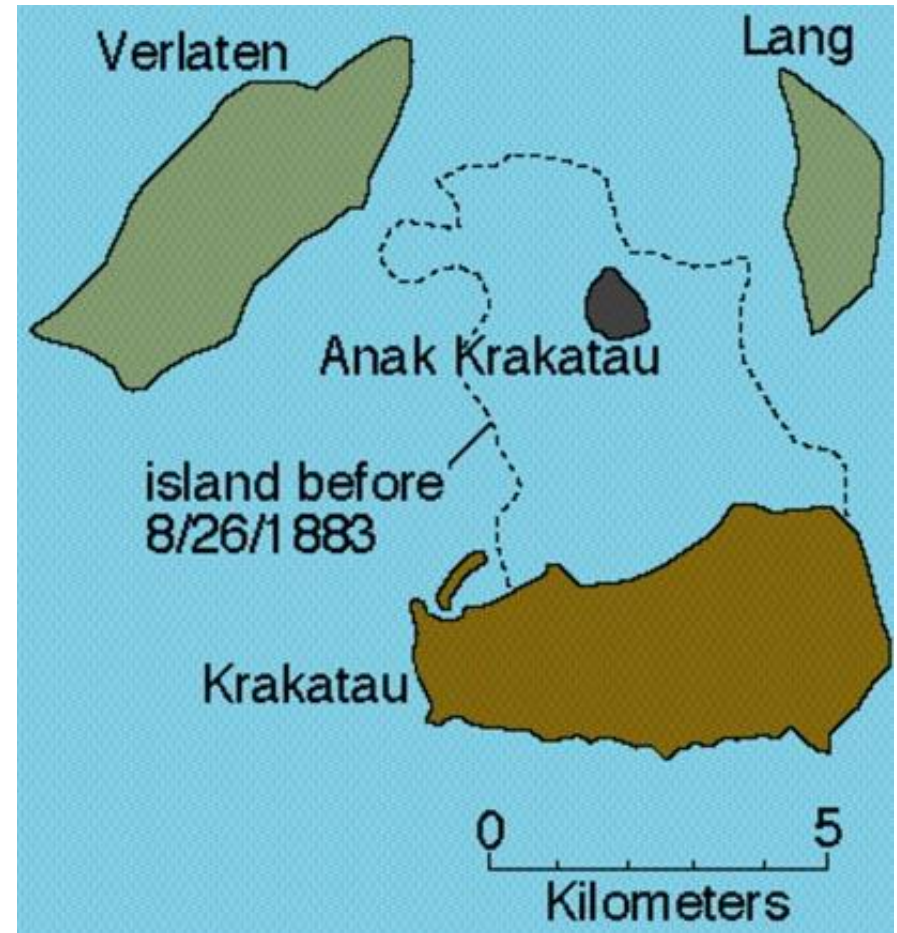
Lessons from Coca Cola



Anak Krakatau

(Child of Krakatau)

1927 A volcano is born





Santorini, the Minoan civilization and the Atlantis myth



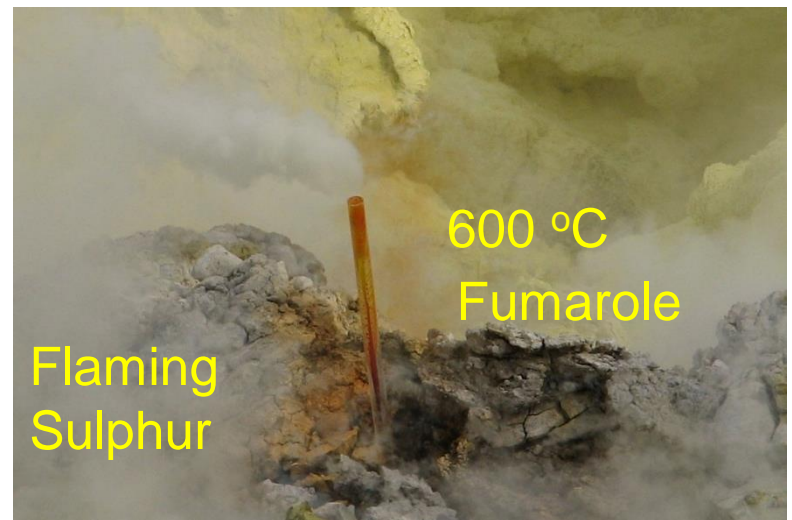
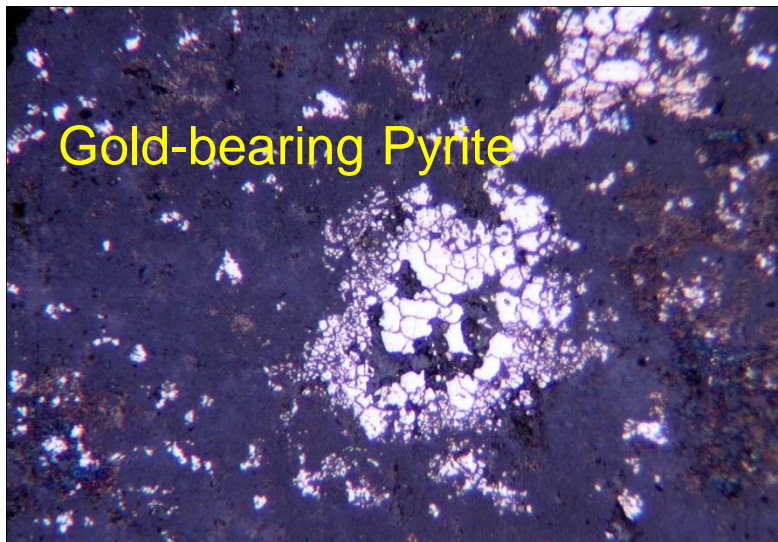
Thera erupts in 1645 BCE
Initiates massive tsunamis
in the direction of Crete,
145 km away

Volcanic degassing, Crater Lakes and the Mining of Sulphur

Kawah Ijen, Indonesia



Kawah Ijen's Gold-depositing gases



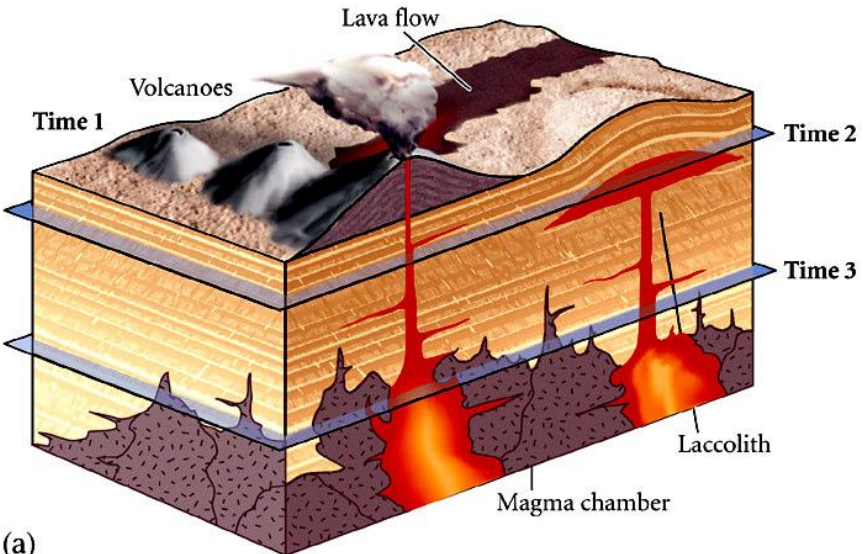
Volcanic gas sampling

Direct sampling of fumaroles

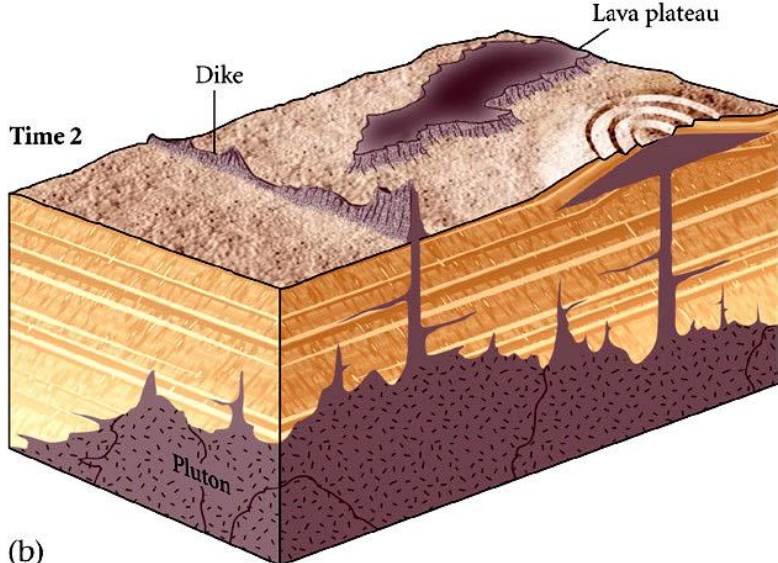
Remote sampling of gases using spectroscopic detector



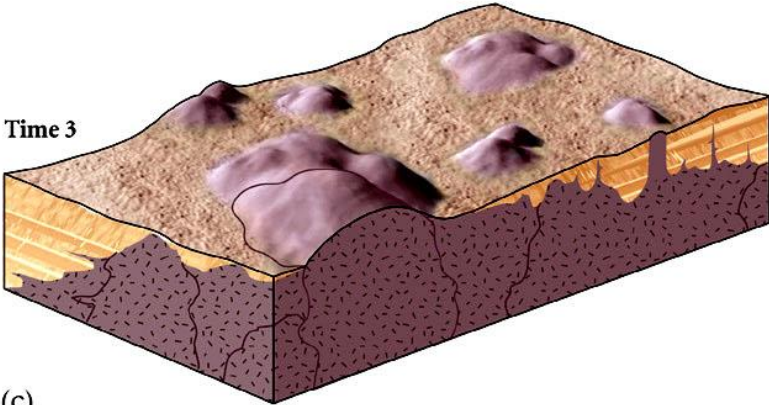
Relationship between volcanoes and intrusions



(a)



(b)



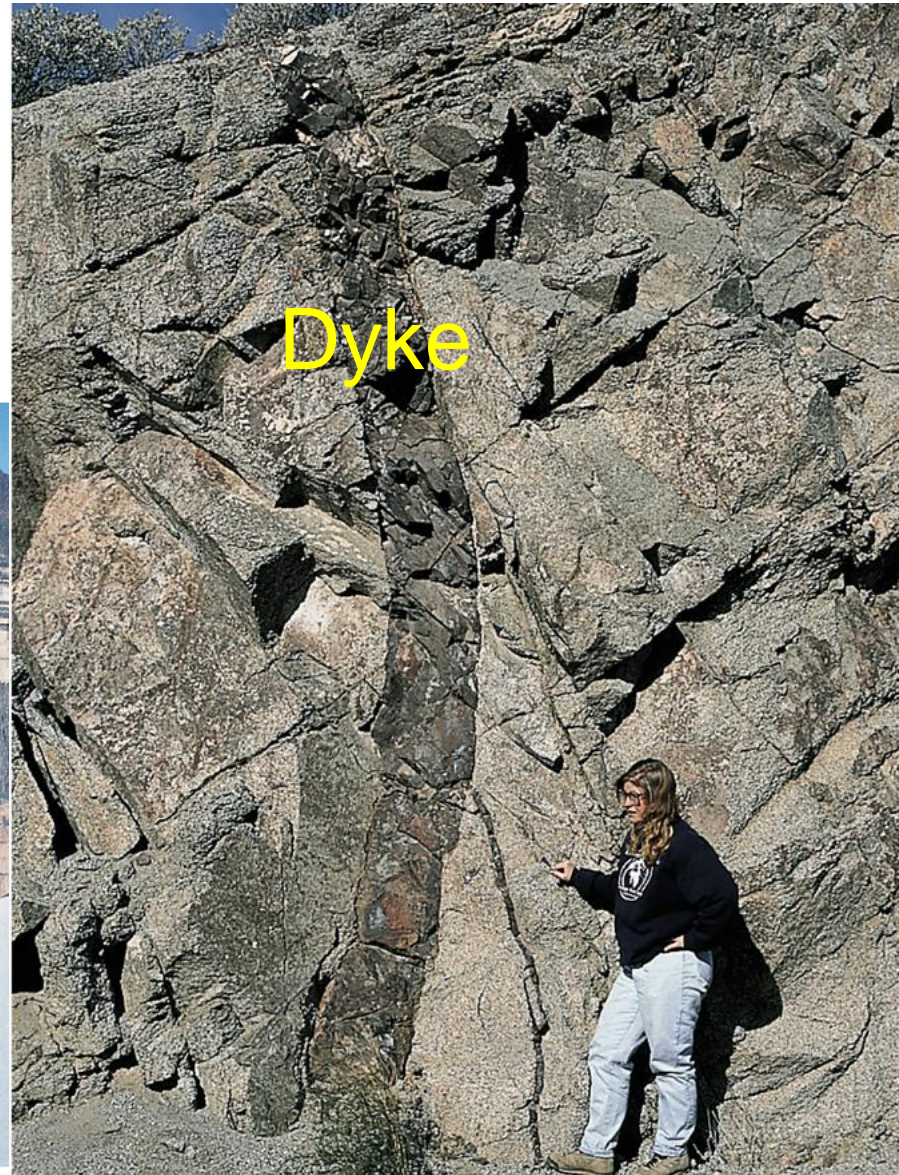
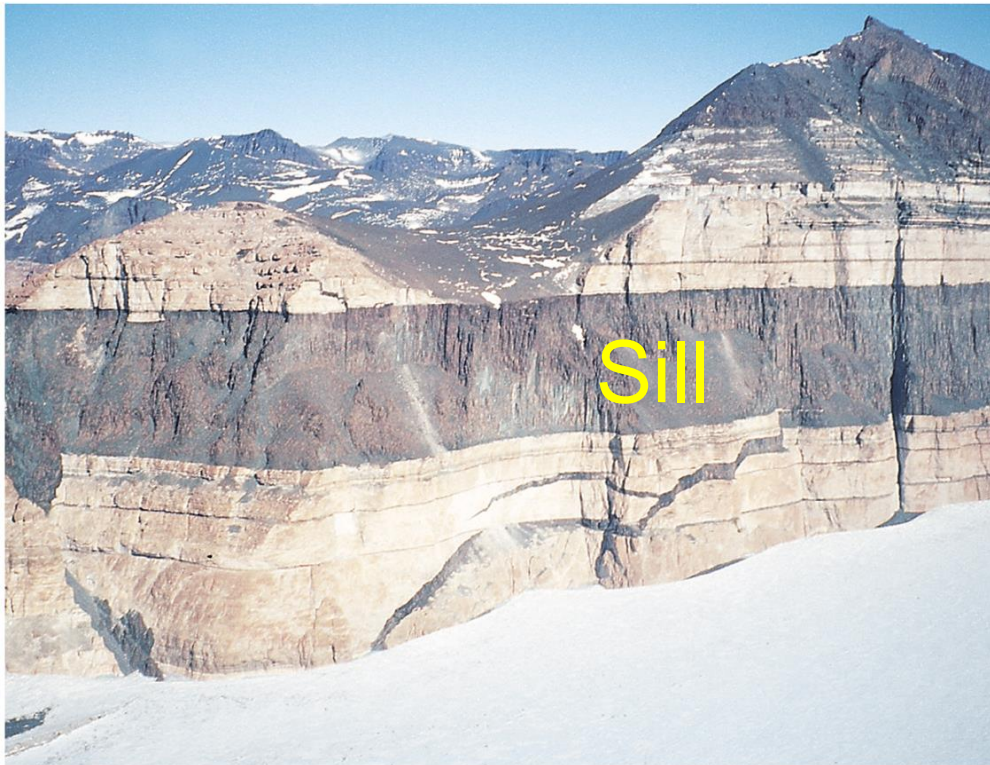
(c)

Erosion to magma chamber - batholith



Intrusions

Dykes and Sills



Volcanoes and Plate Tectonics

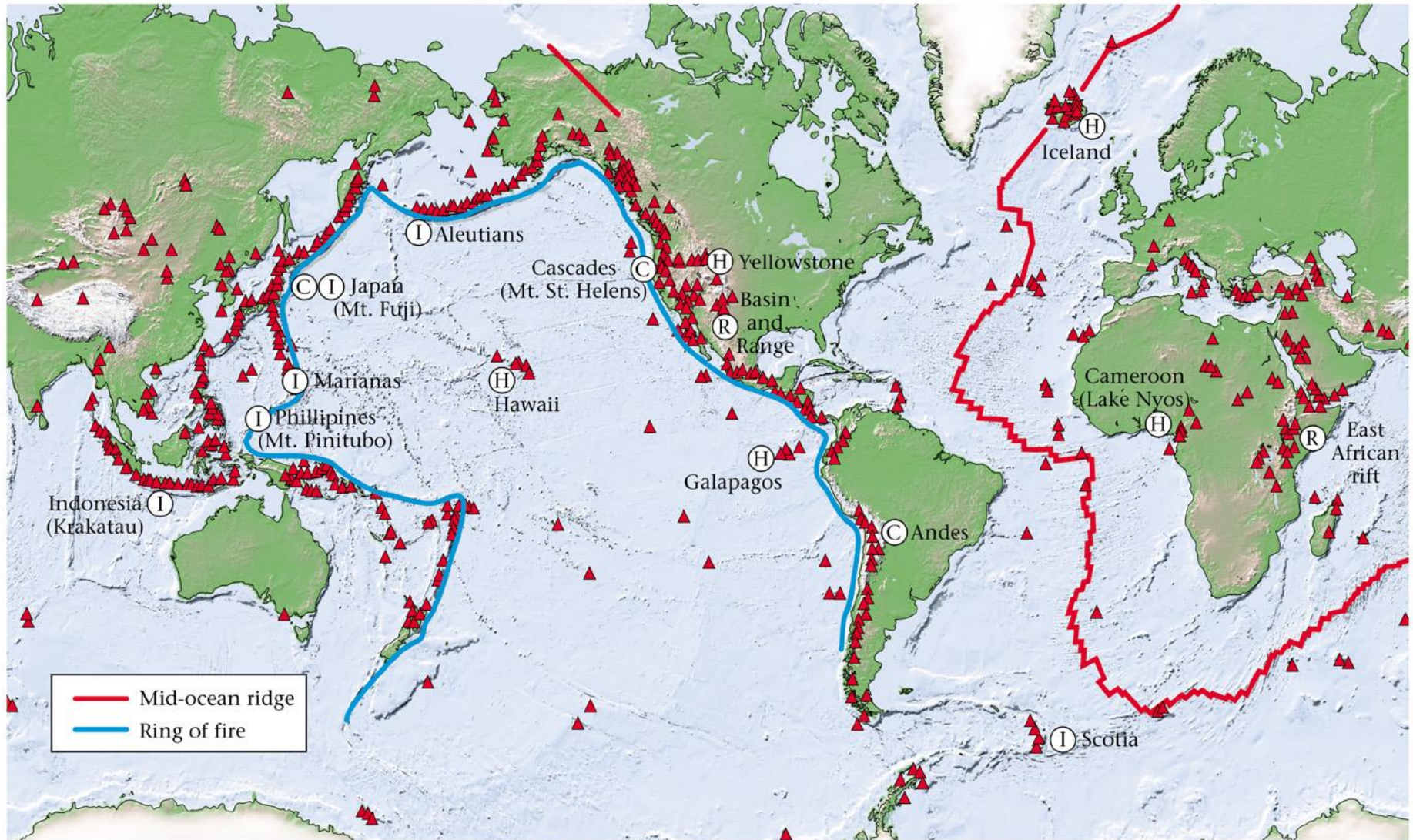
Ⓘ = Island arc

Ⓒ = Continental arc

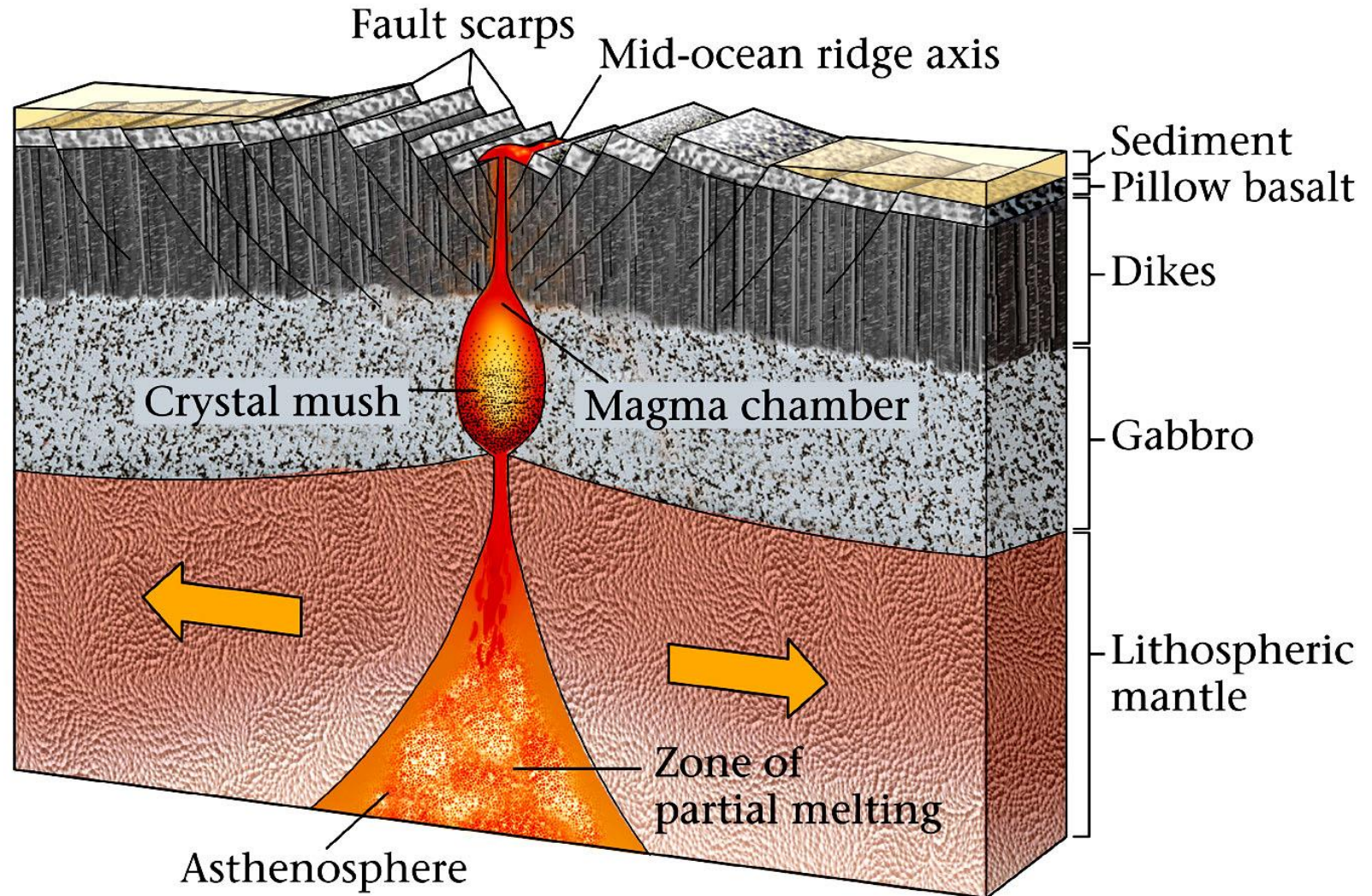
Ⓓ = Rift

Ⓗ = Hot spot

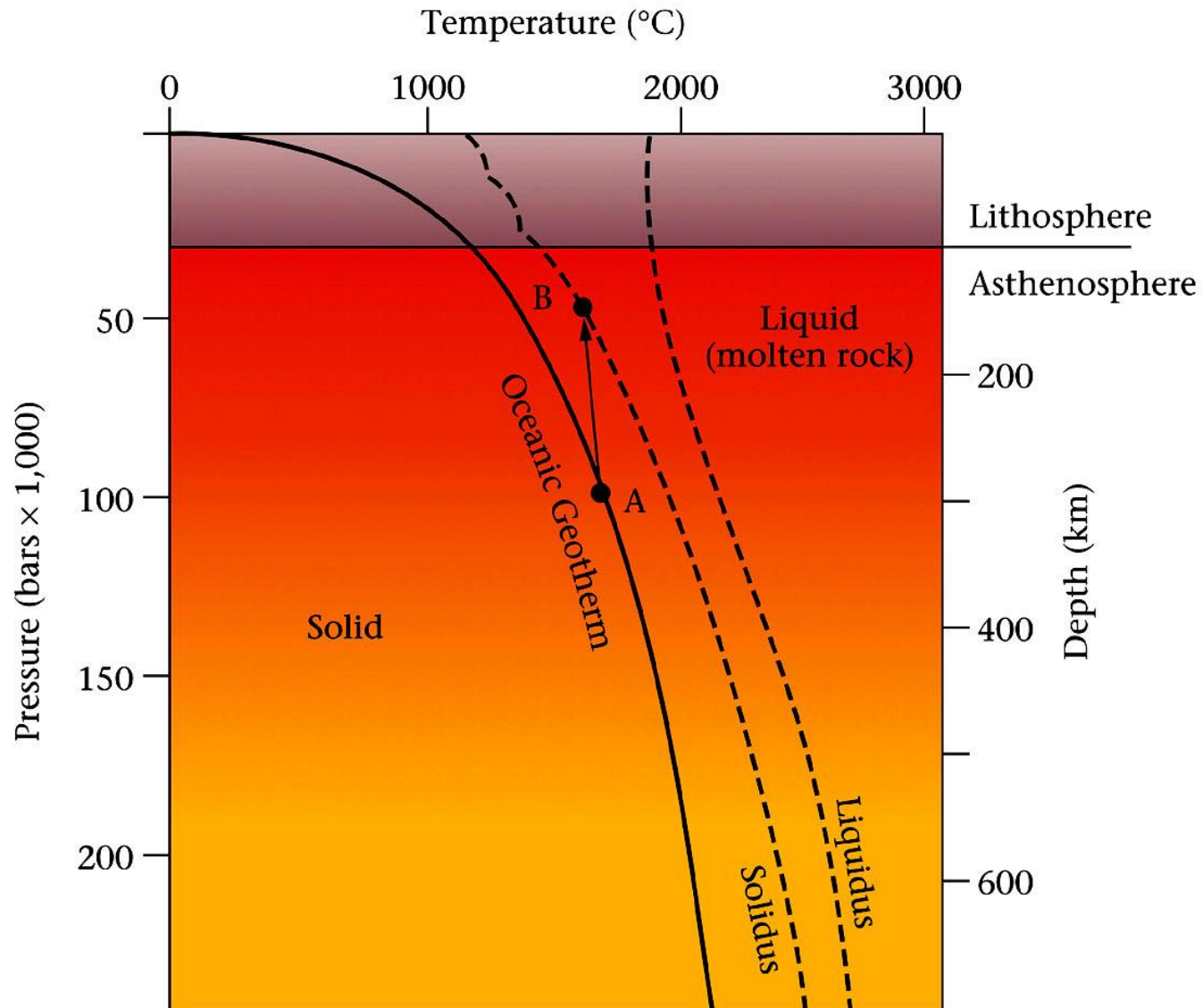
Ⓜ = Mid-ocean ridge



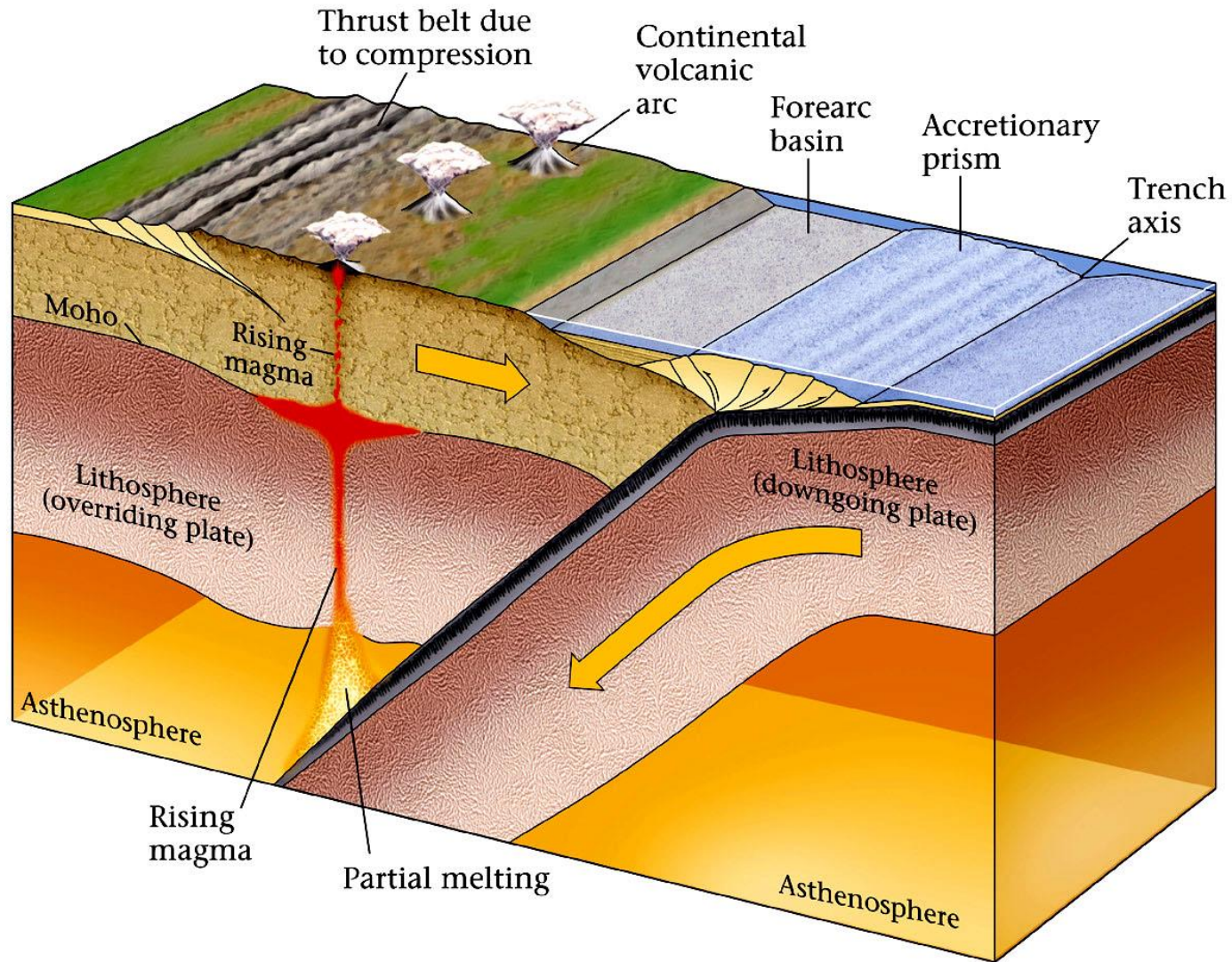
Melting at a Spreading Centre



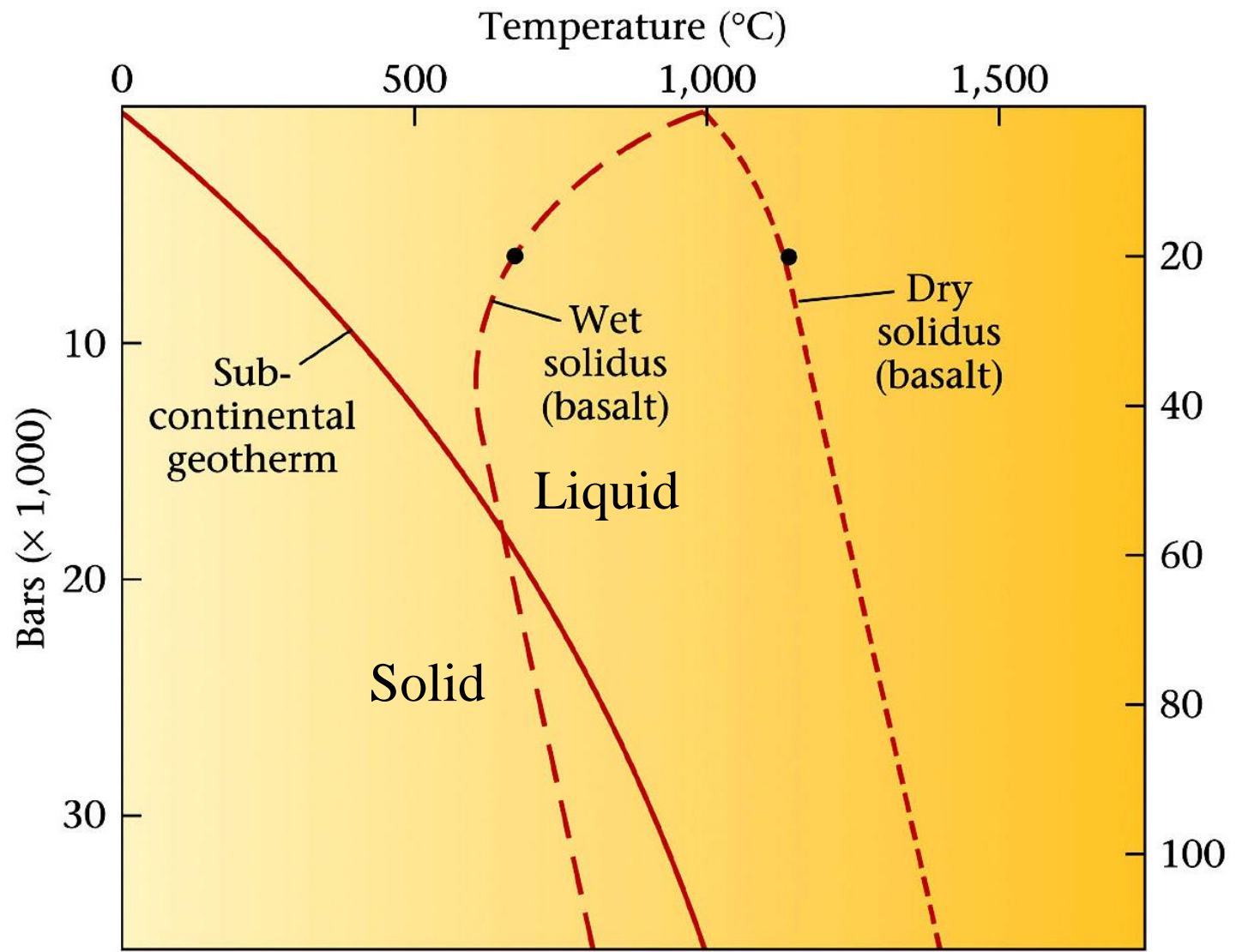
Decompression melting – Spreading Centres, Rifts, Hot spots



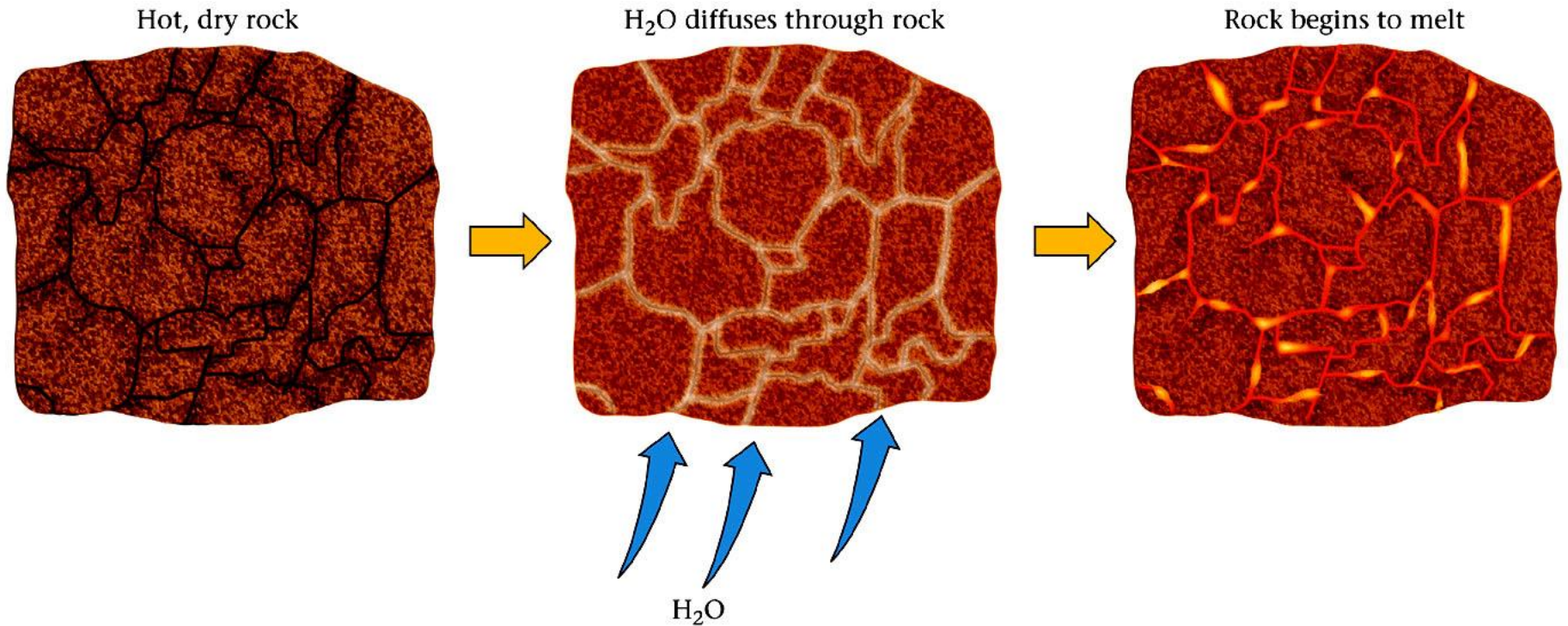
Melting at a Subduction Zone



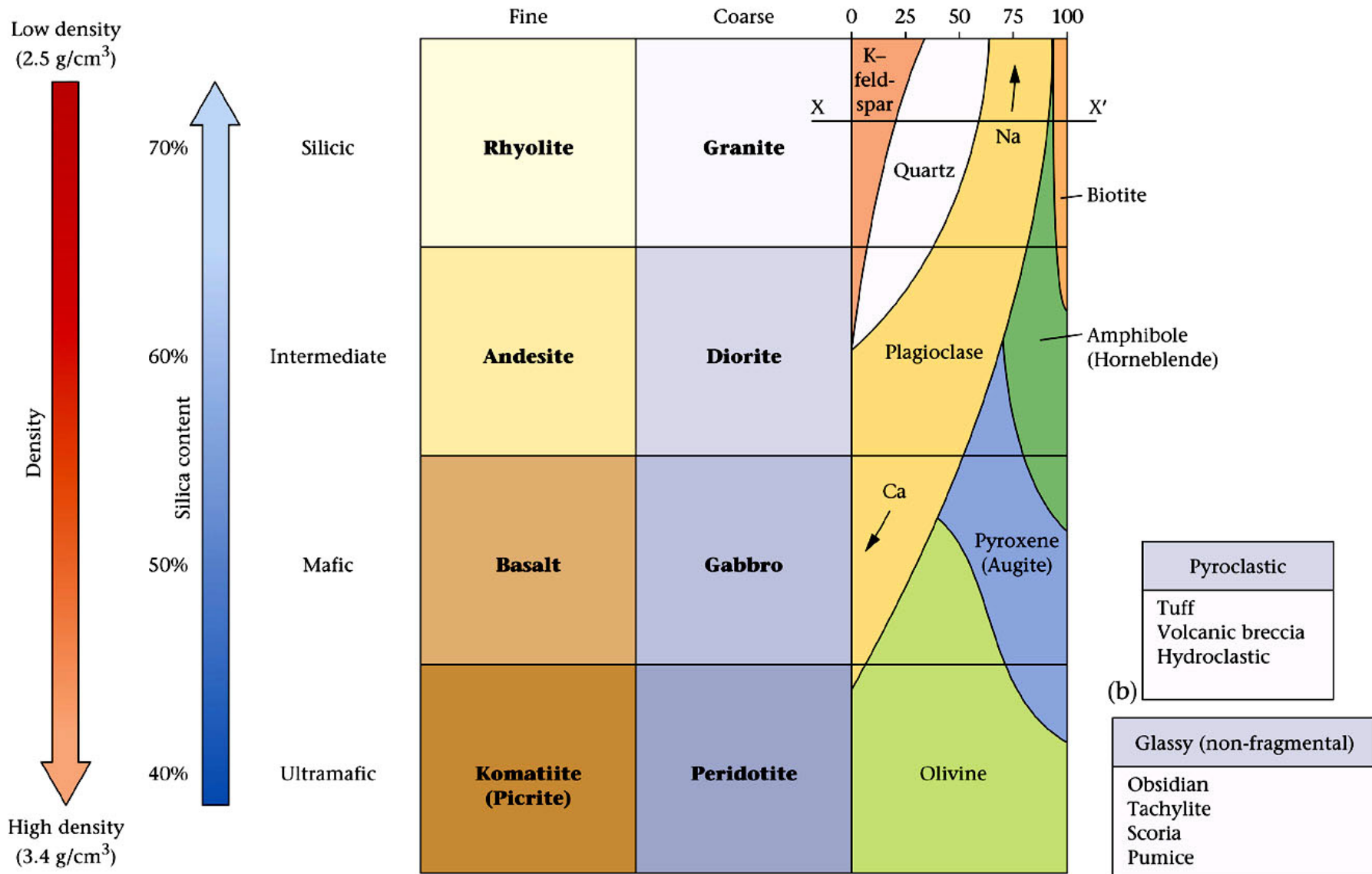
Hydration Melting – Subduction Zones



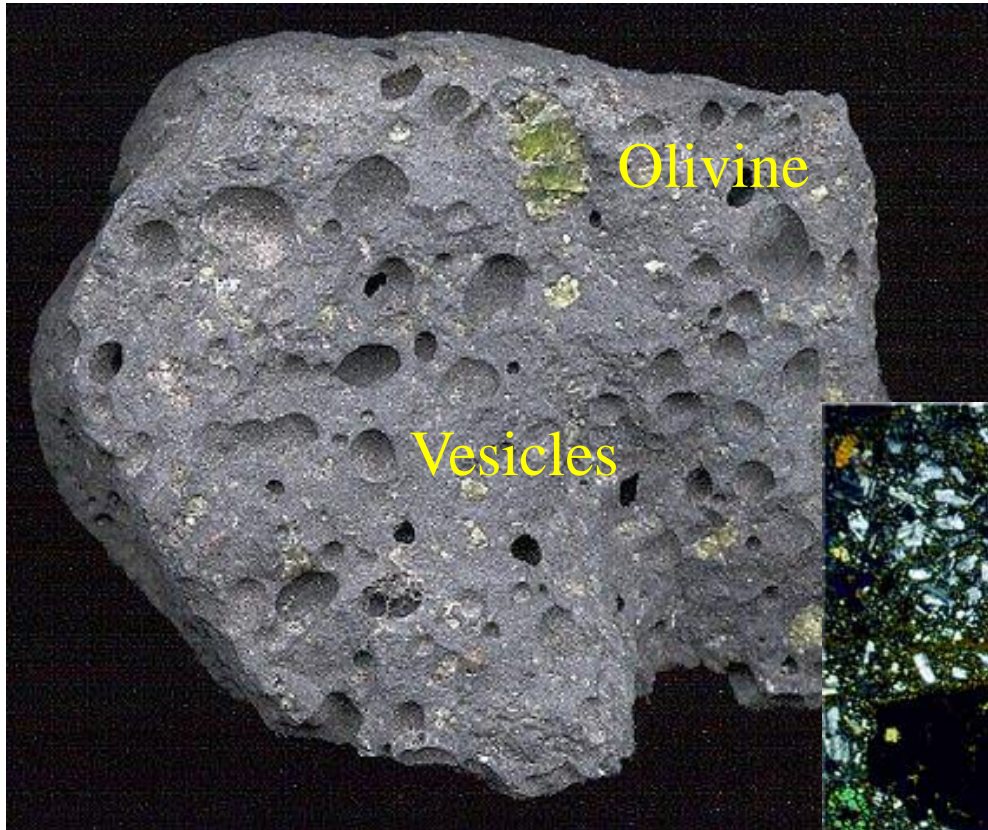
Hydration melting – the role of H₂O



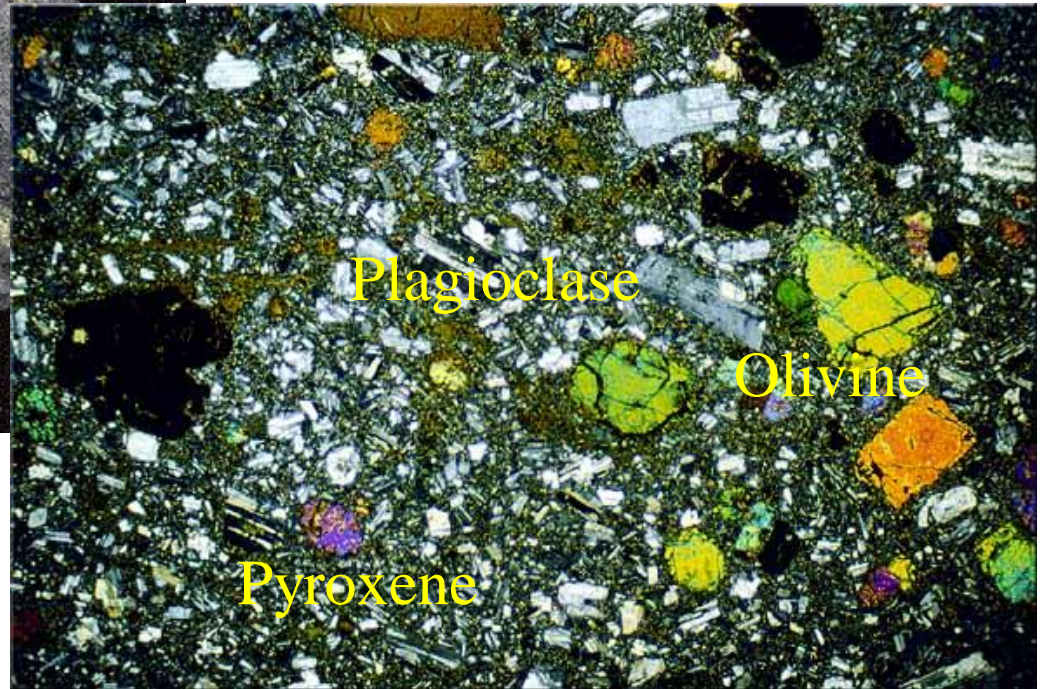
Classification of Igneous Rocks



Basalt



Microscope Image

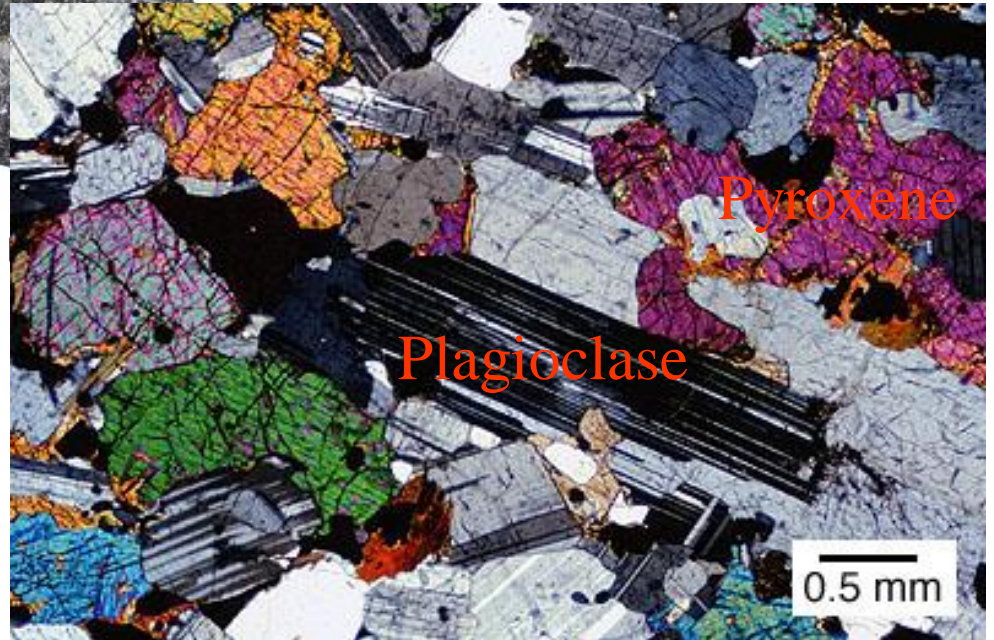


Gabbro

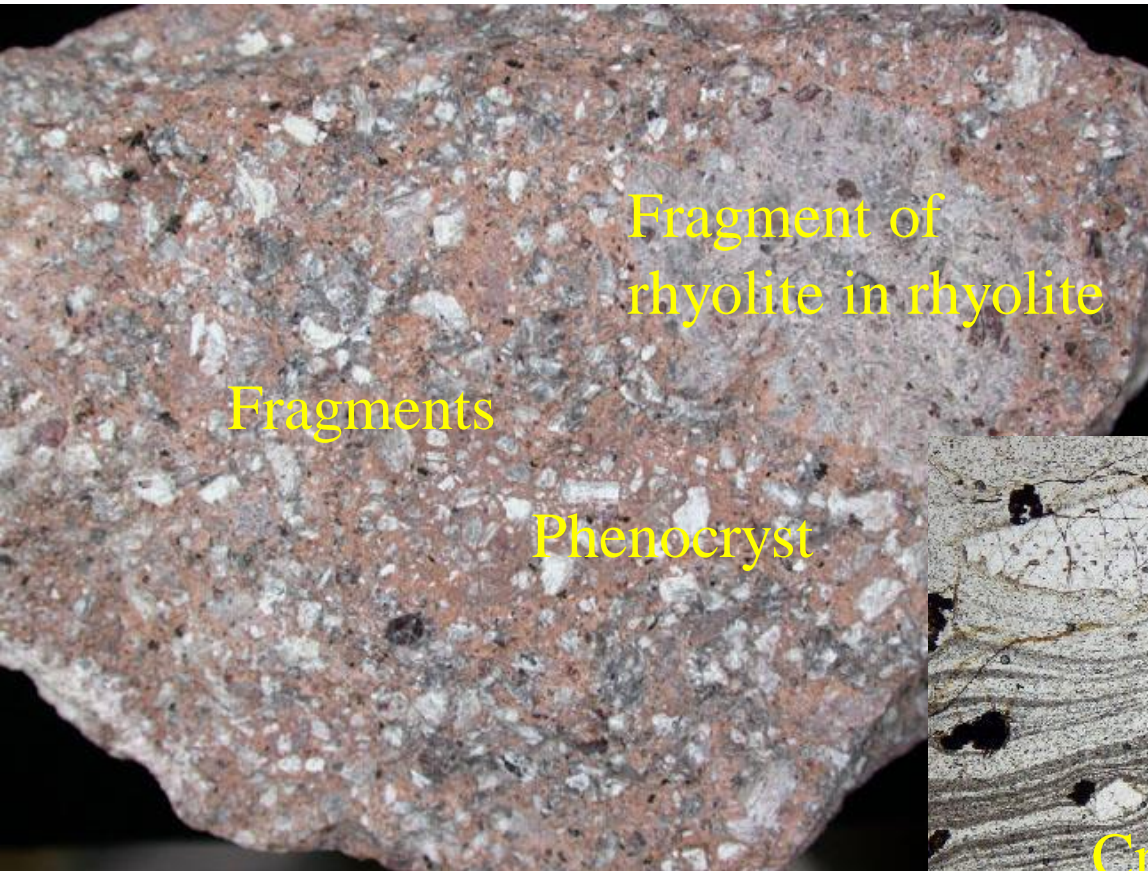
Light – Ca-rich plagioclase

Dark - pyroxene

Microscope image



Rhyolite



Microscope image



Pumice – vesiculated glass



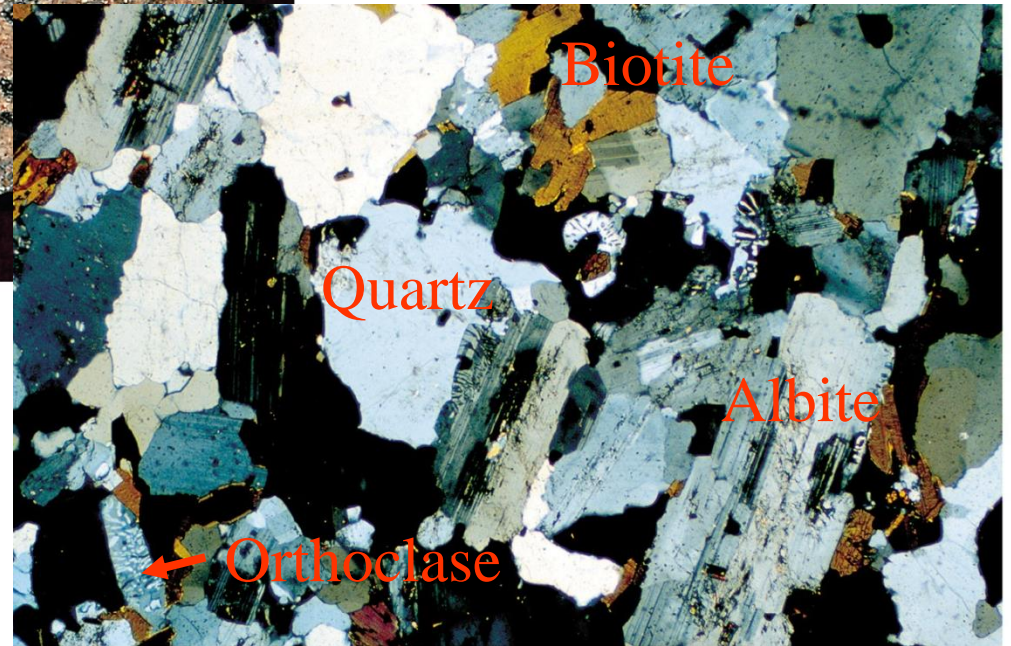
Obsidian (Rhyolite glass)



Partially Devitrified obsidian



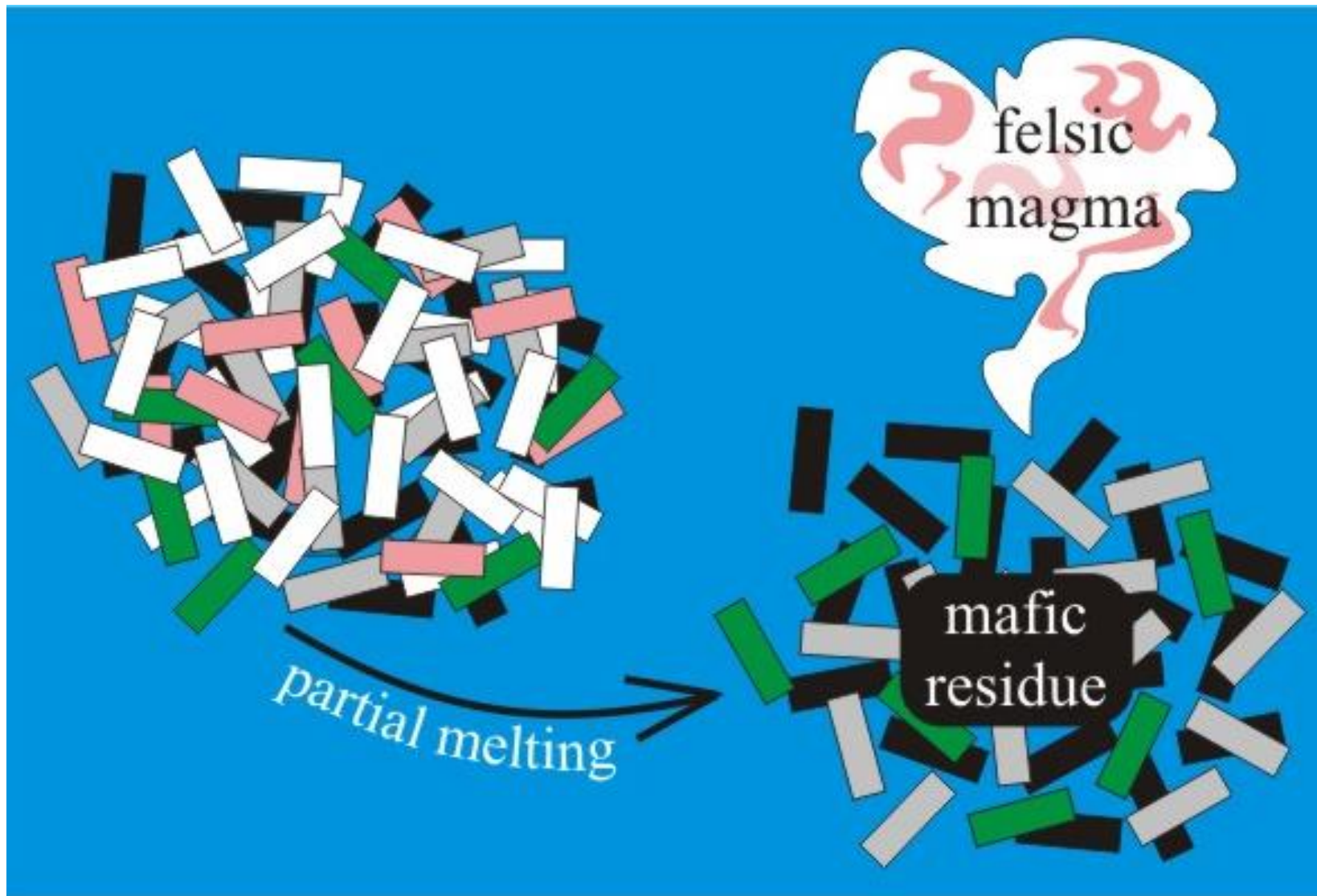
Granite



b)

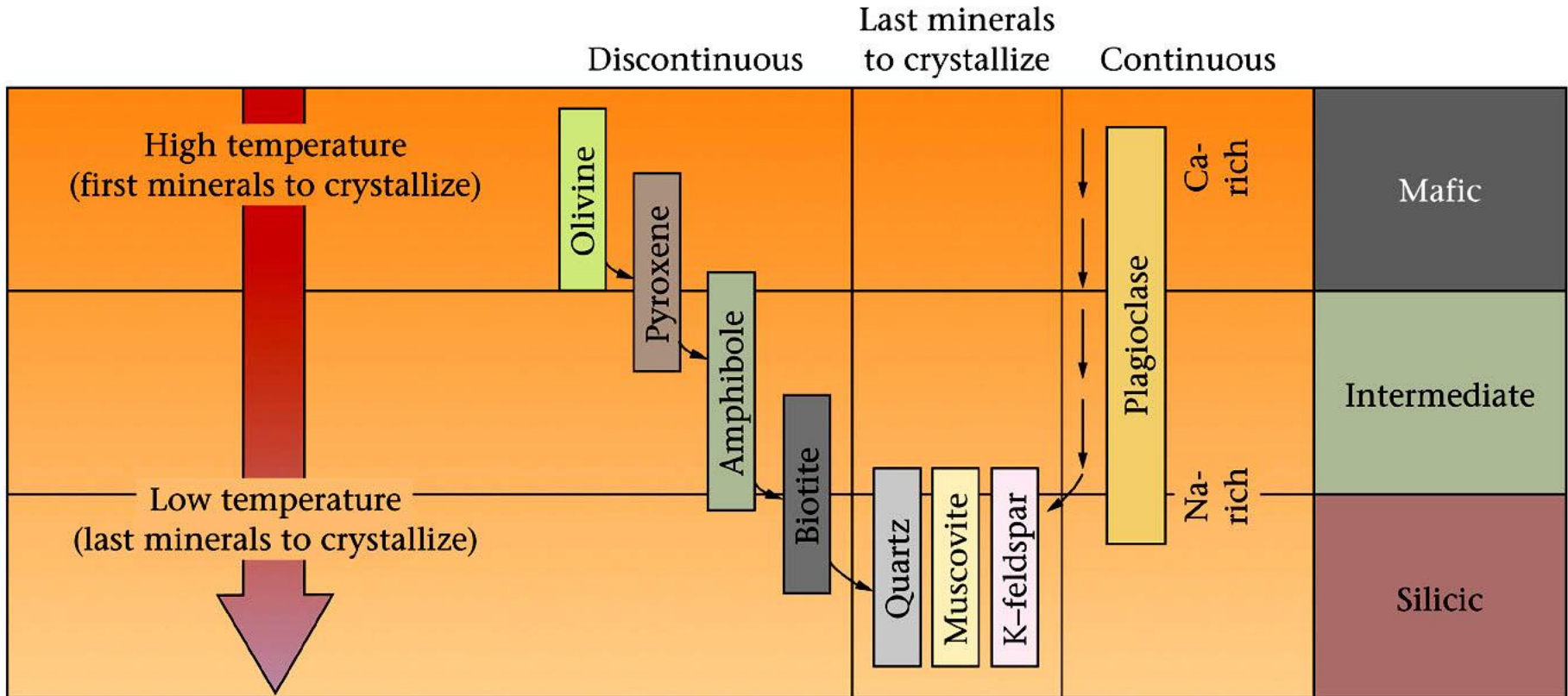
0 Mm 0.5

Partial Melting



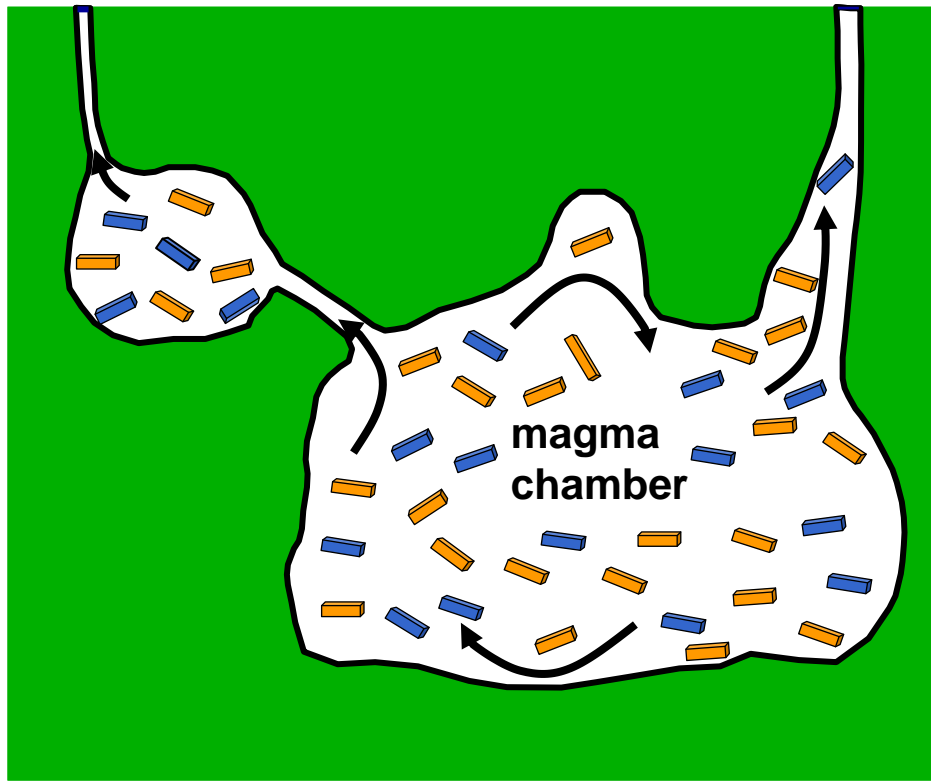
Bowen's Reaction Series

Equilibrium and fractional crystallization



Equilibrium and Fractional Crystallization

Equilibrium crystallization



Fractional crystallization

