



# Earth and Space Science

## Lecture 1: The Ocean Floor (Chapter 13)

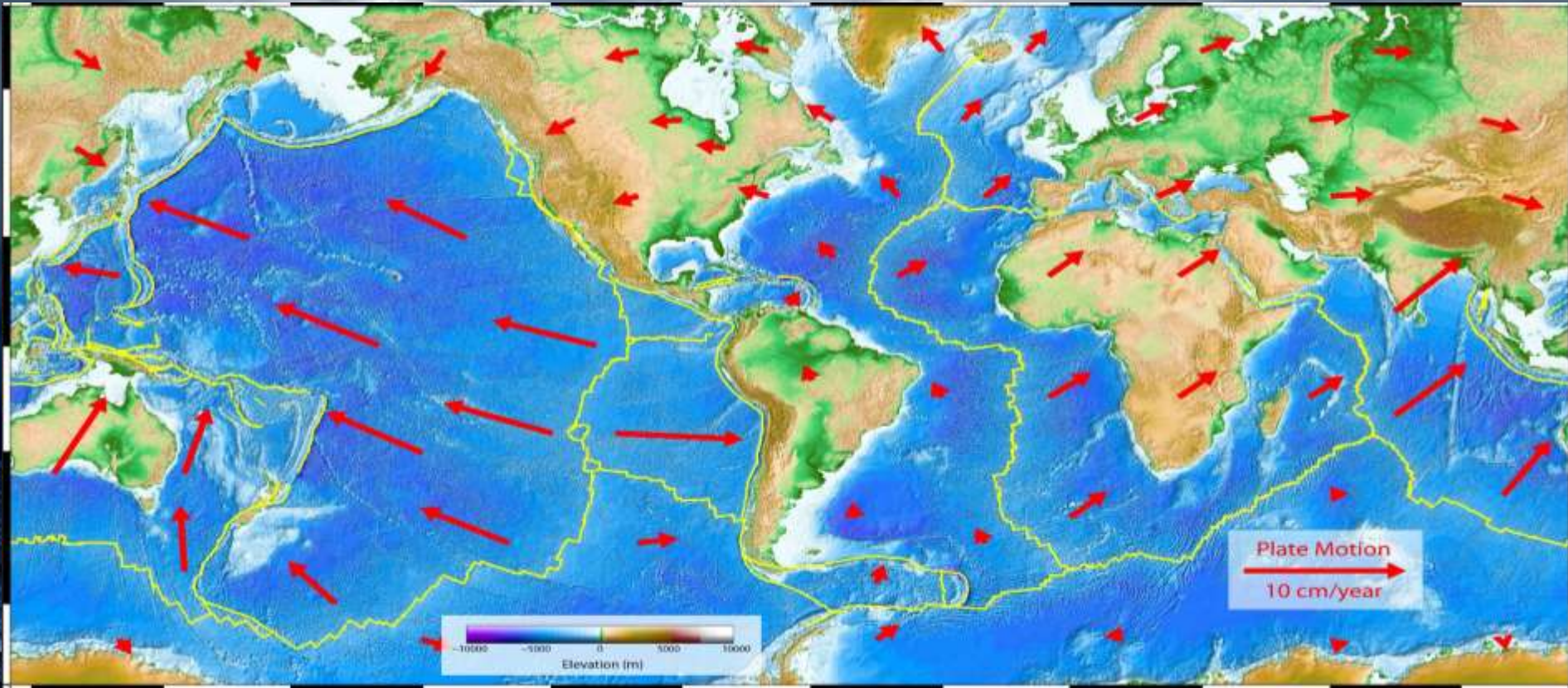
# The Oceans



- 71% of Earth is covered by Water
  - 61% of the Northern Hemisphere
  - 81% of the Southern Hemisphere

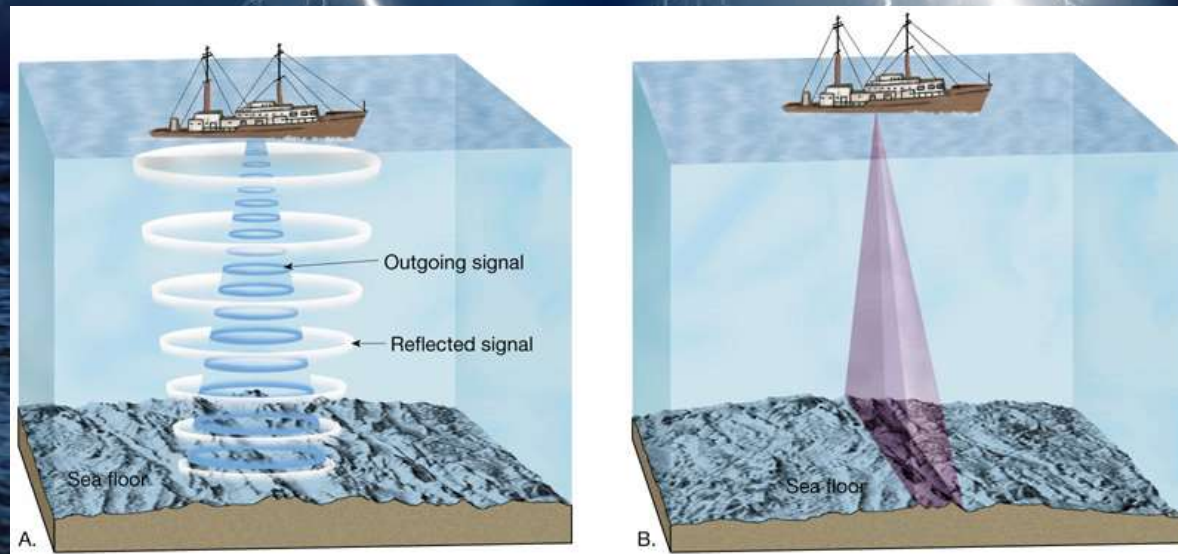
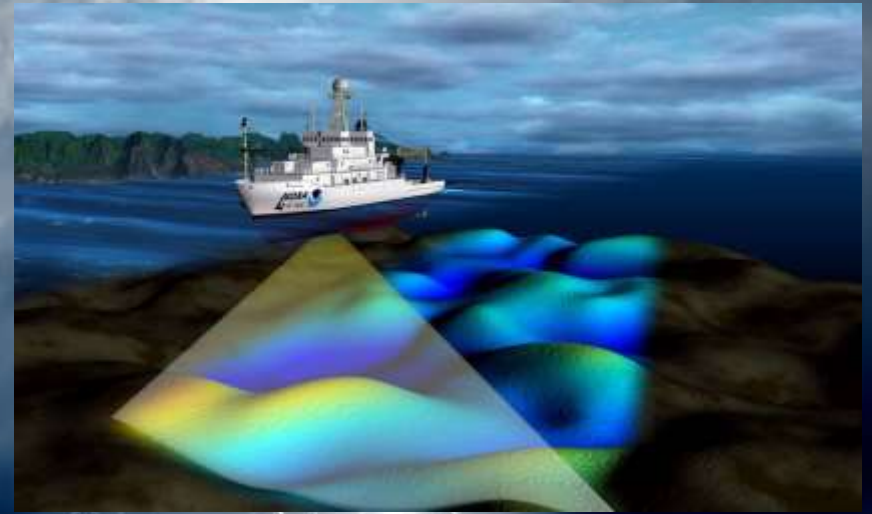
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# Plate Tectonics

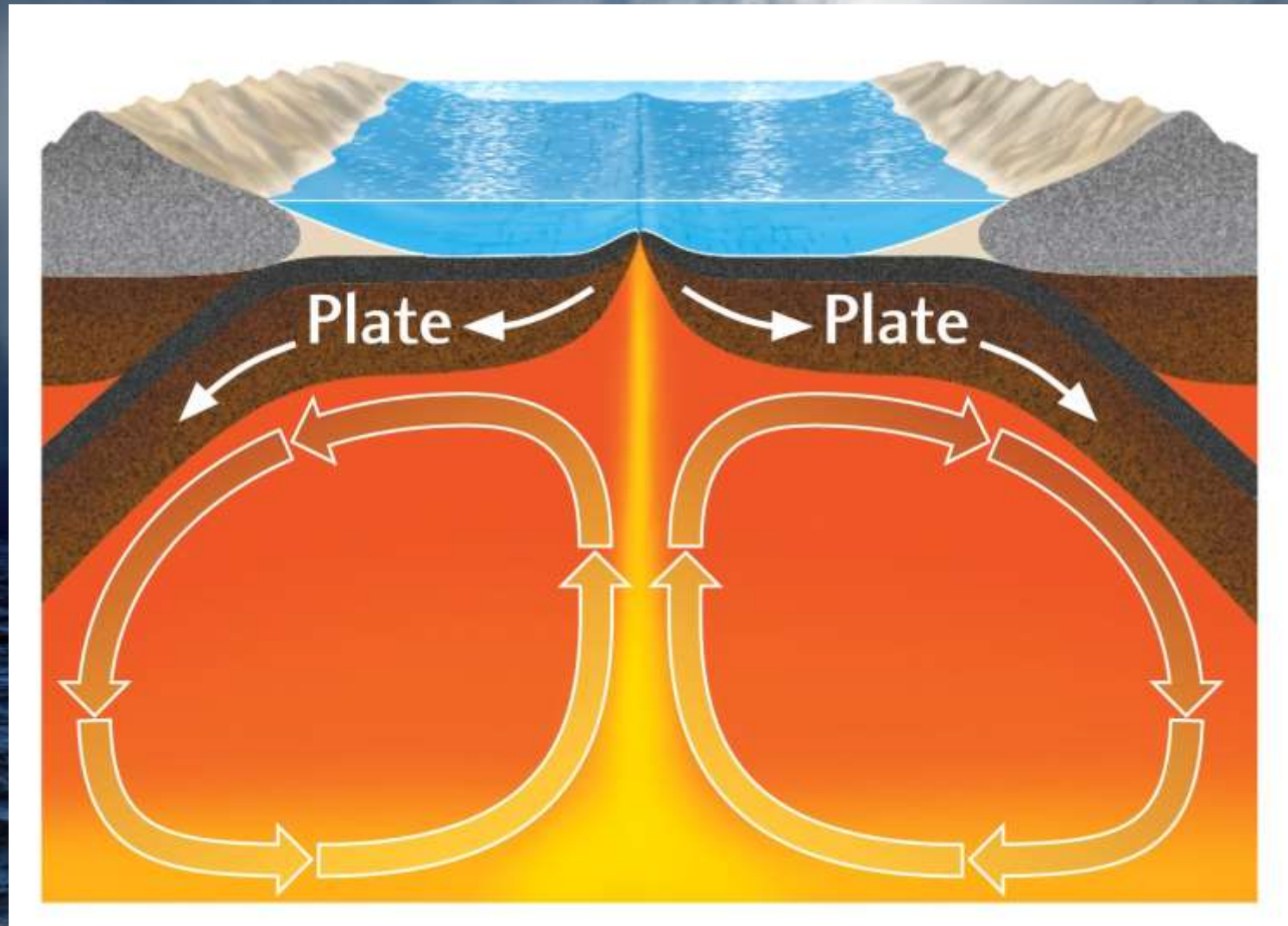


# Mapping the Ocean Floor

**Bathymetry**: The measurement of ocean depths and the charting of the topography of the ocean floor.

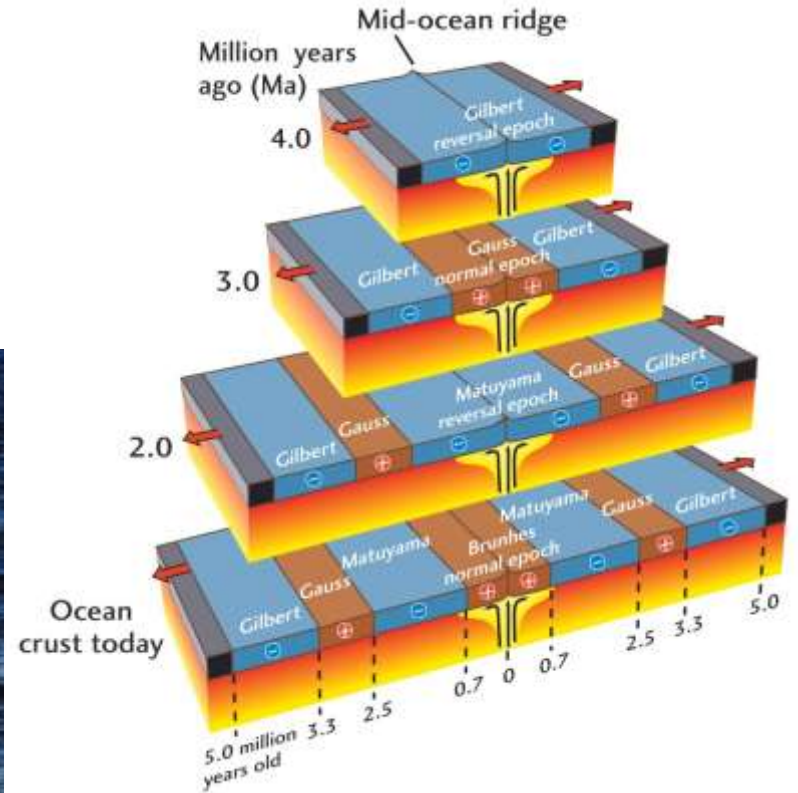
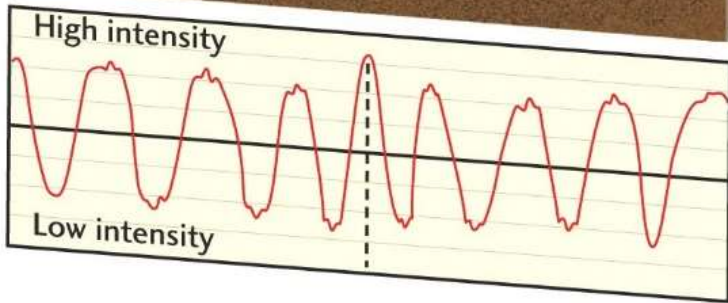
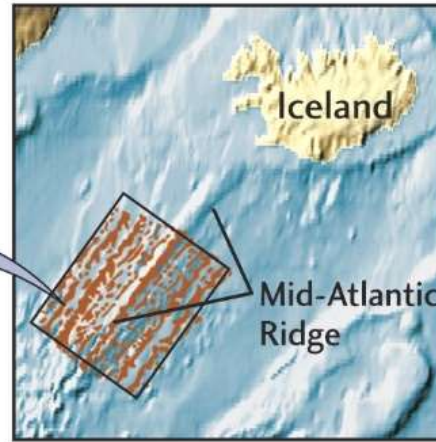
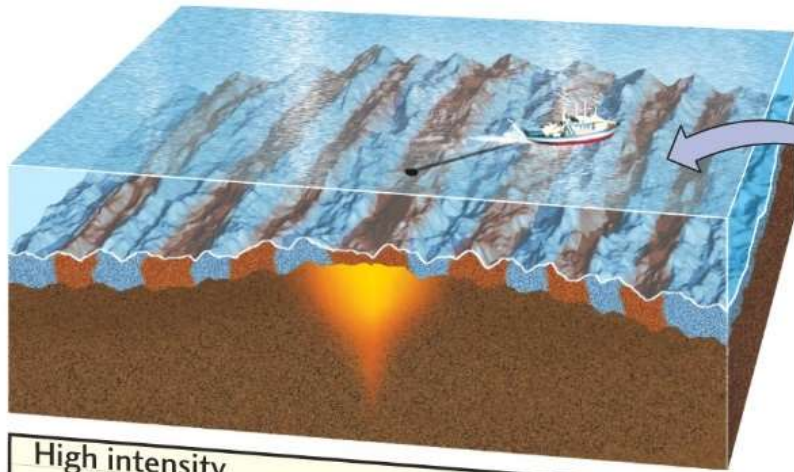


# Mantle Convection



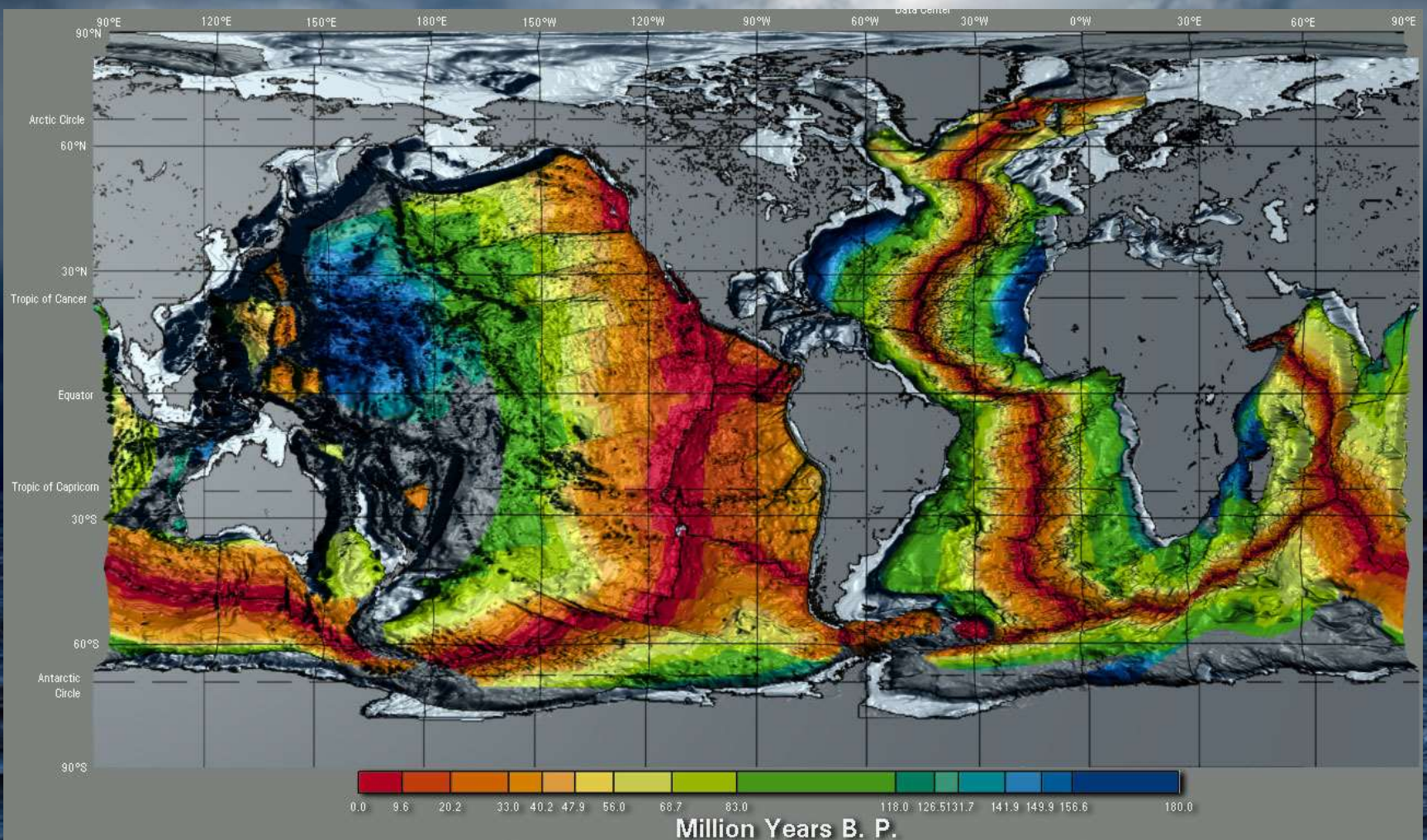
# MAGNETIC MAPPING CAN MEASURE THE RATE OF SEAFLOOR SPREADING

# Ocean Floor Magnetic Stripes

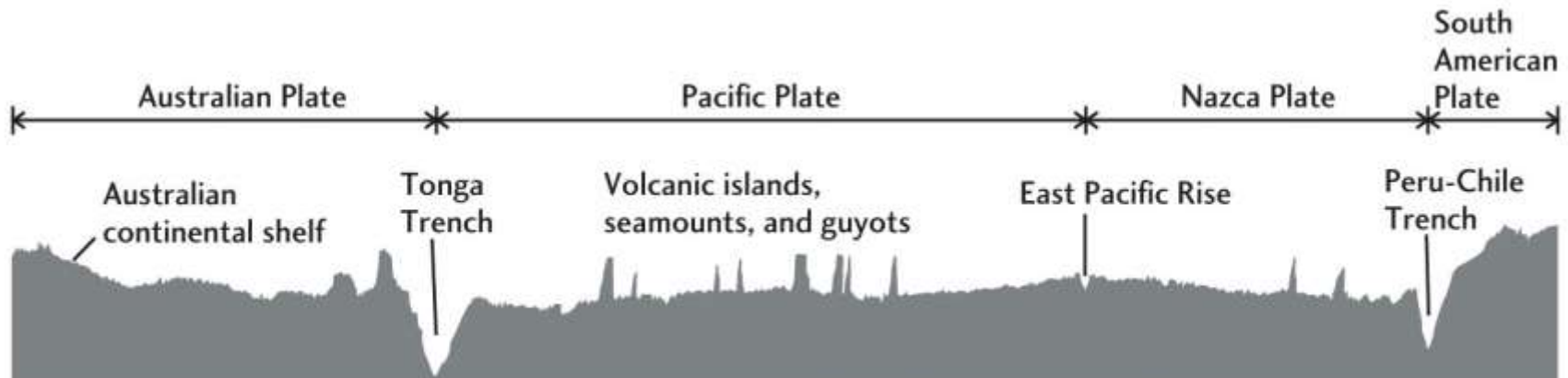
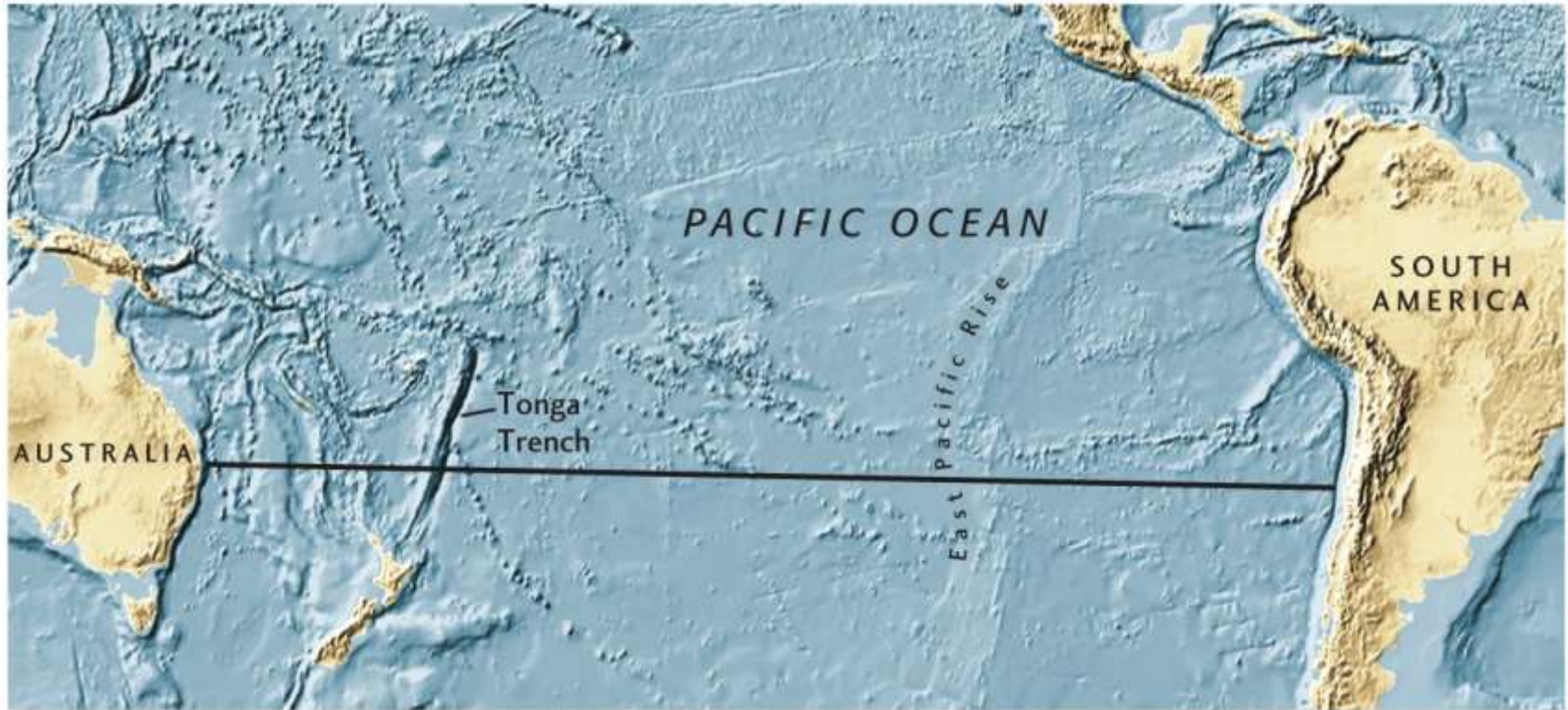


- New oceanic crust records Earth's magnetic field when it forms
- Spreading seafloor moves away from the ridge as newer crust is formed in a conveyor belt fashion

# Age of the Ocean Floor



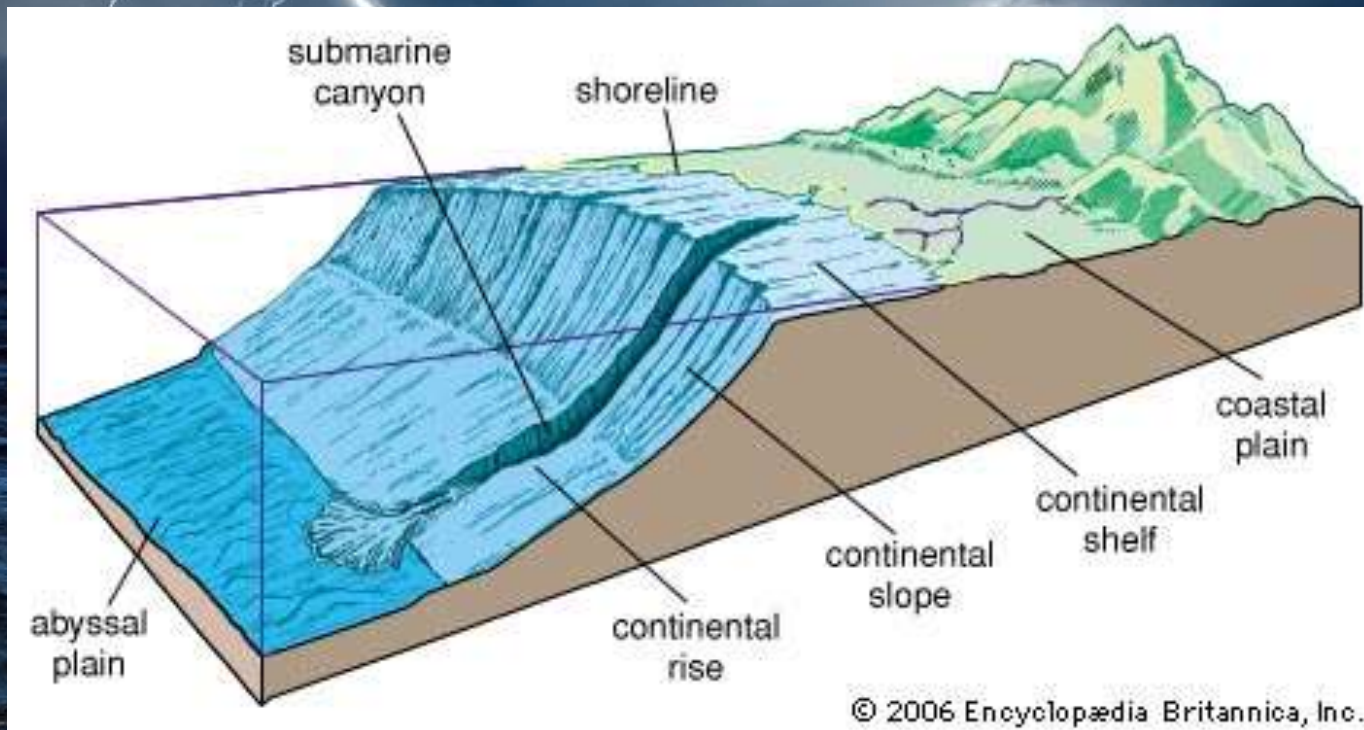
# Cross Section of the Ocean Floor





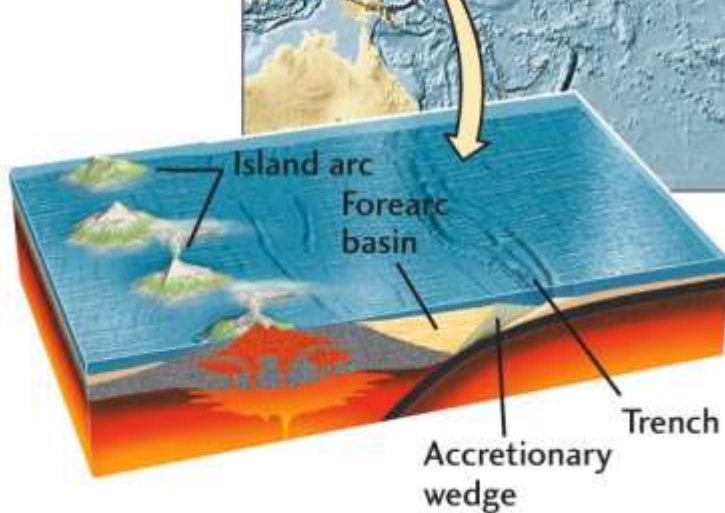
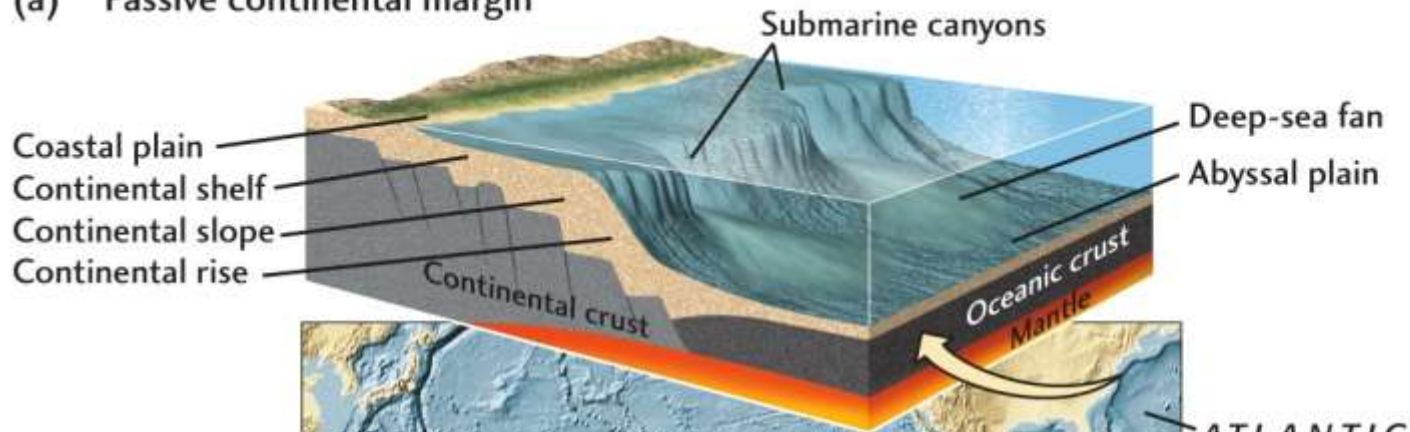
# Continental Margins

- Are the outer margins of the continents where continental crust transitions to oceanic crust.

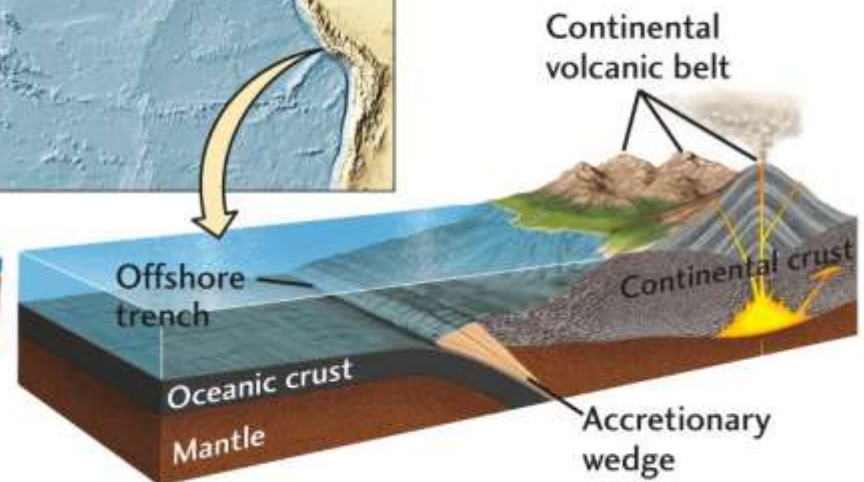


# Types of Continental Margins

(a) Passive continental margin



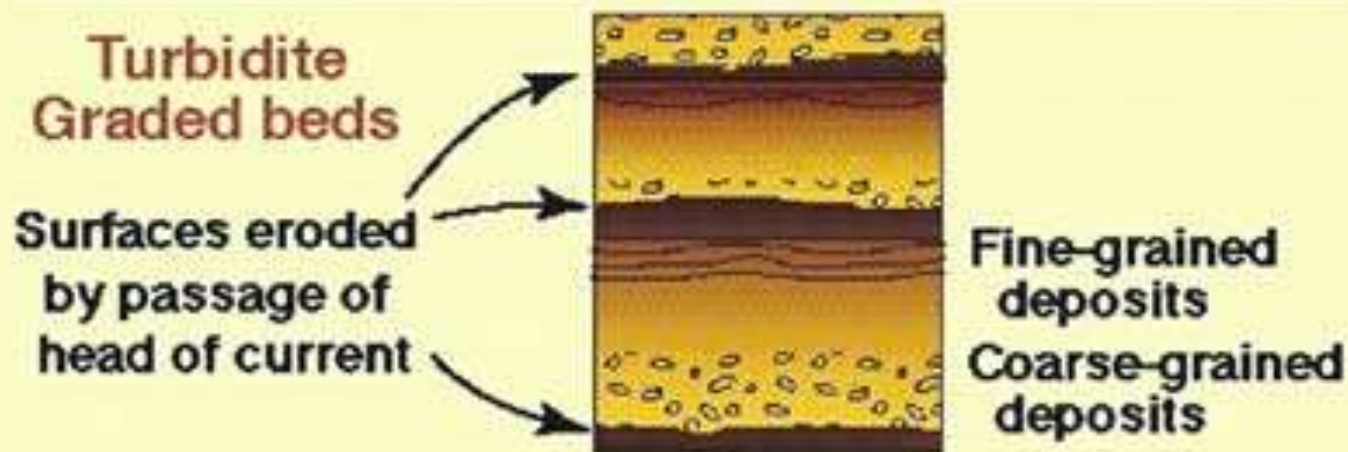
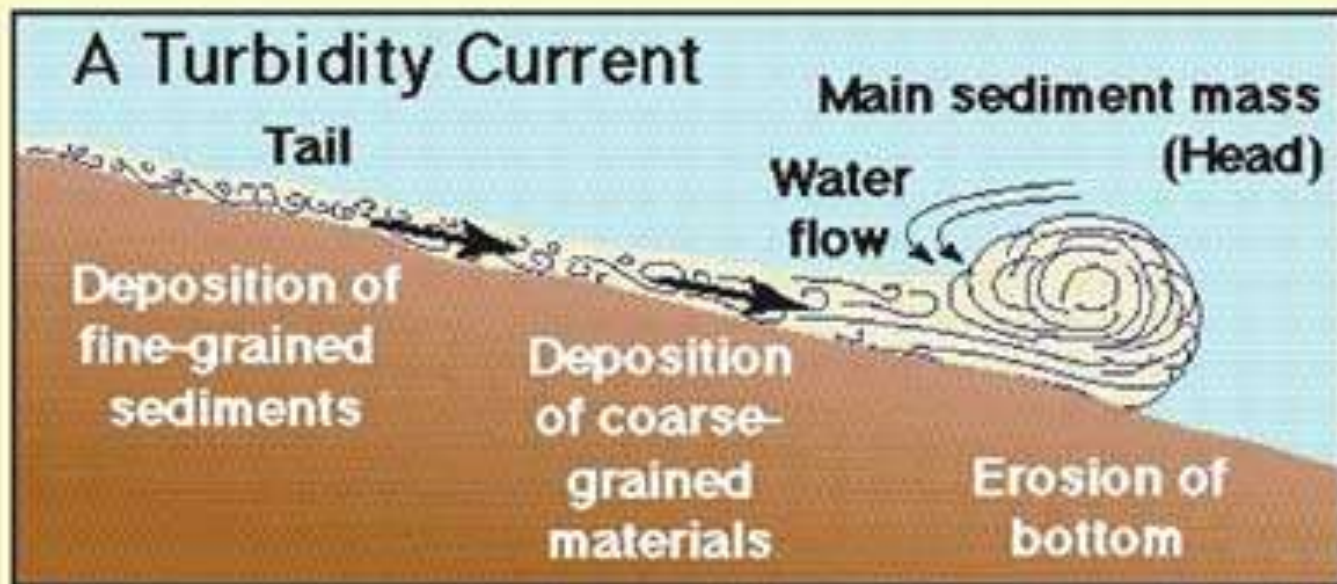
(b) Active margin of the Marianas type



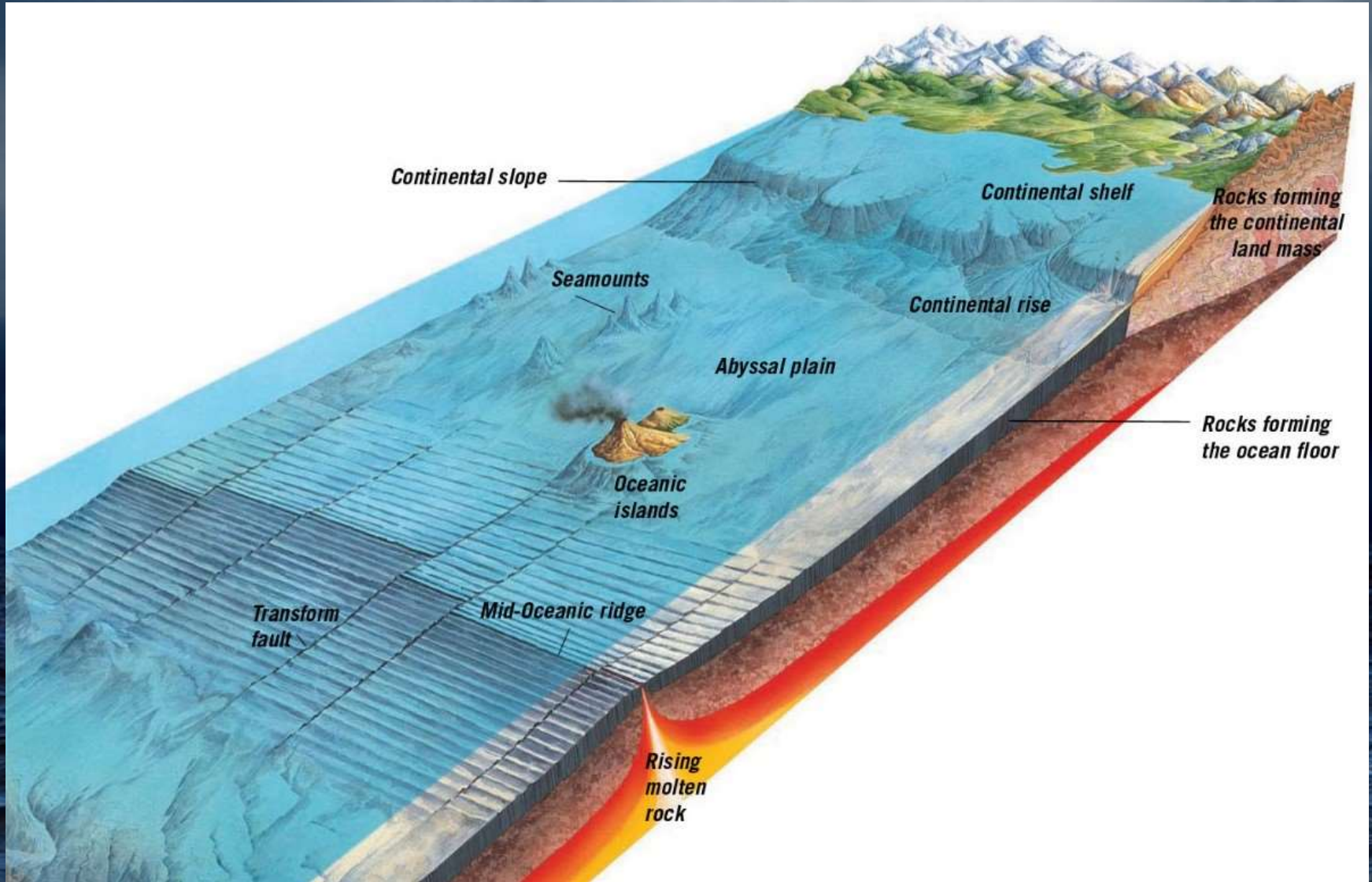
(c) Active margin of the Andean type

# Turbidity Currents

Are downslope movements of dense, sediment-laden water.

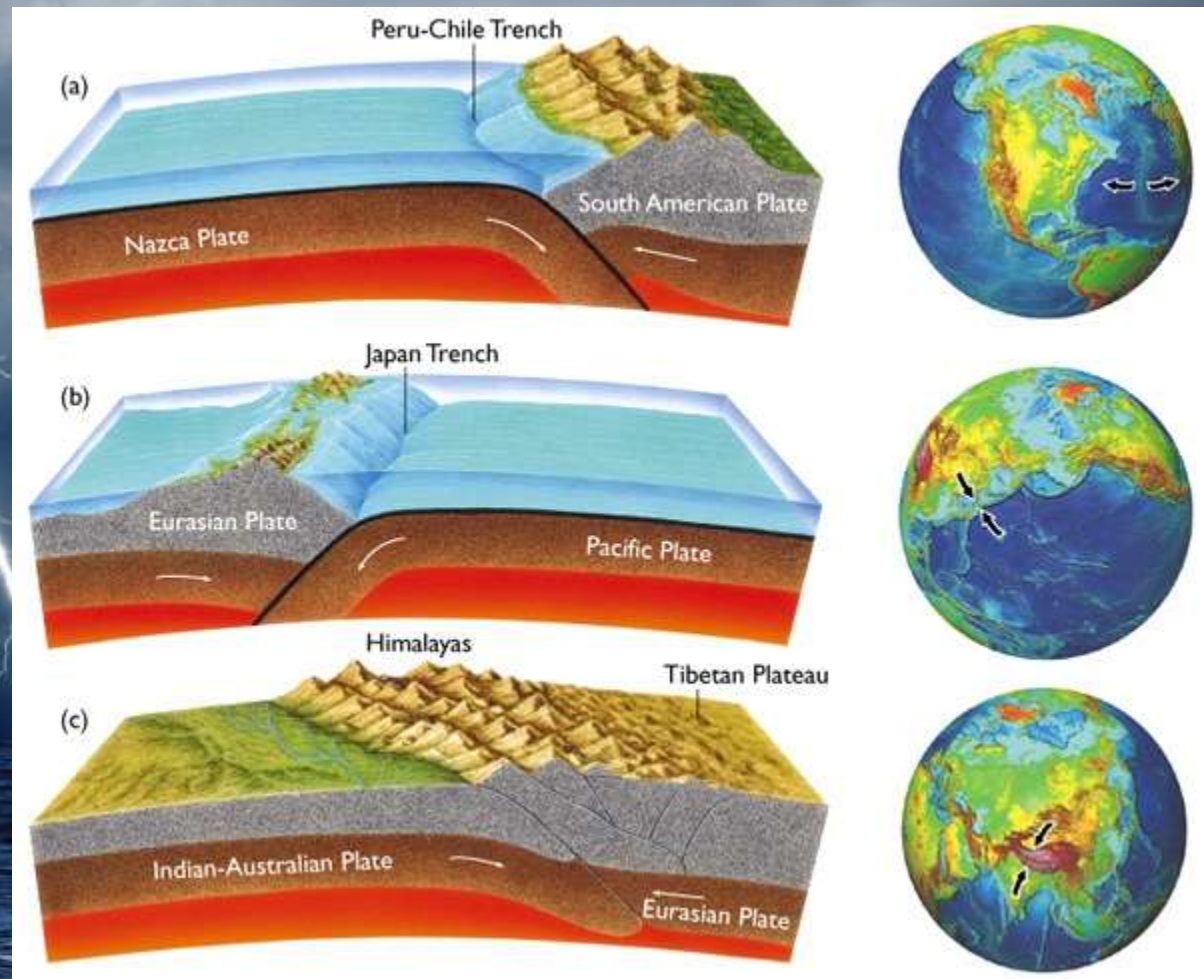


# Features of the Deep Ocean



# Deep-ocean Trench

- Are long, relatively narrow troughs that are the deepest parts of the ocean.
- Most trenches are located along the margins of the Pacific Ocean, where many exceed 10 km (6 miles) in depth.



# Abyssal plain

- Are deep incredibly flat features; in fact, these regions are likely the most level places on the Earth.

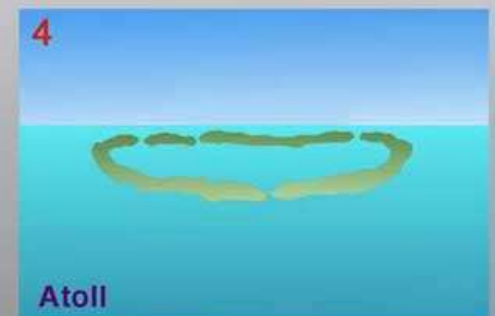
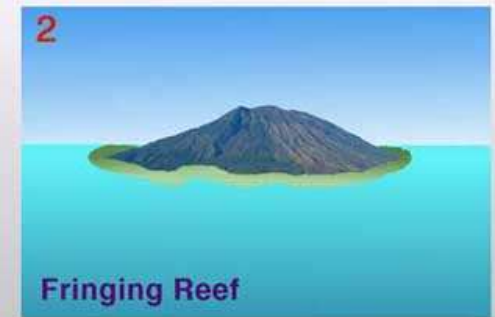


# Volcanic Structures on the Ocean Floor



# Coral Atolls

Coral Atolls are ring-shaped structures that often extend from slightly above sea level to depths of several thousand meters



Atoll Formation in the Indo-Pacific



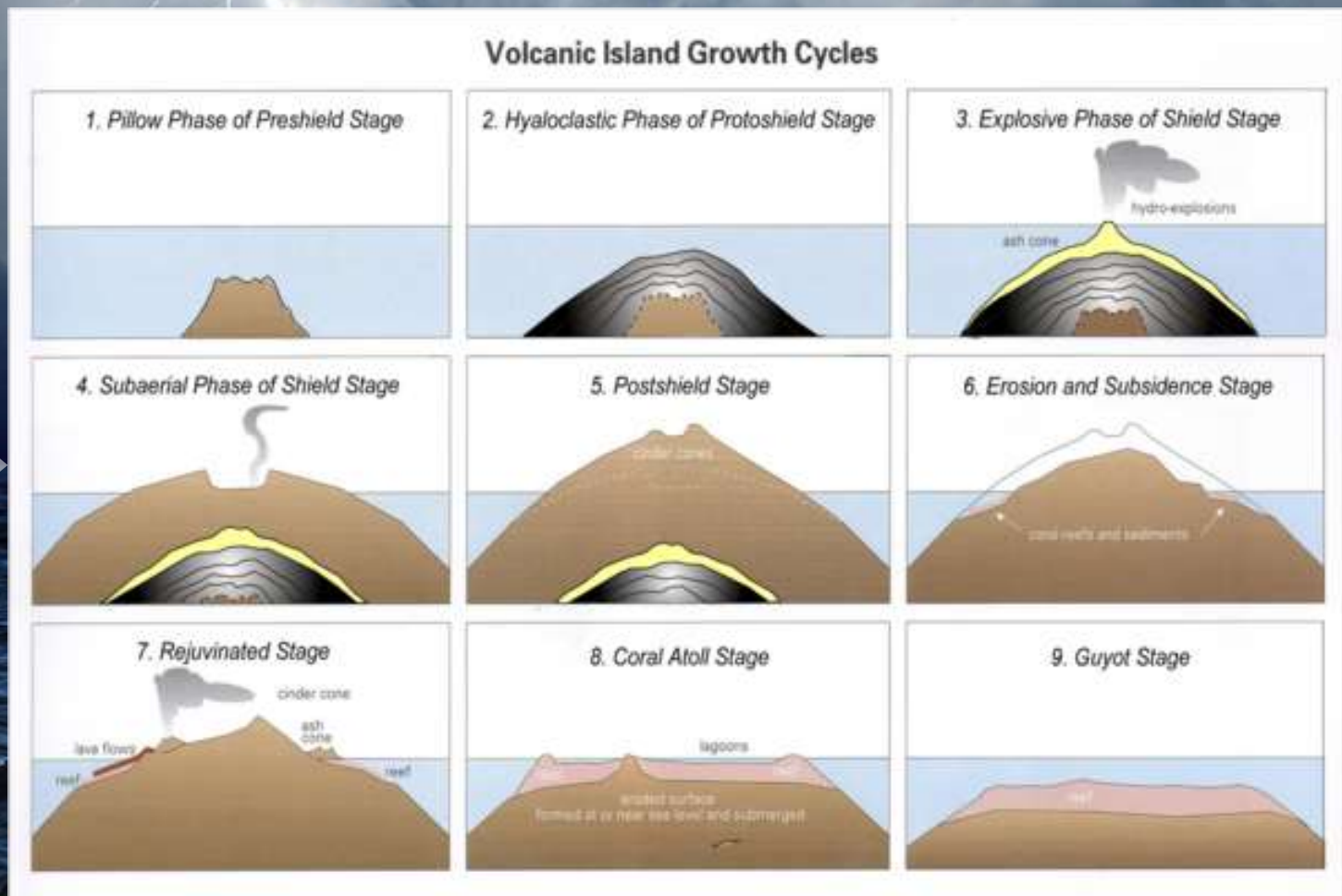
# Seamounts and Volcanic Islands

- Seamounts are submarine volcanoes that can rise hundreds of meters above the surrounding topography.
- Some grow large enough to become oceanic islands, but most do not have a sufficiently long eruptive history to build a structure above sea level.



# Guyots

- During their existence, inactive volcanic islands are gradually but inevitably lowered to near sea level by the forces of weathering and erosion.
- Submerged, flat-topped seamounts that formed in this manner are called guyots.

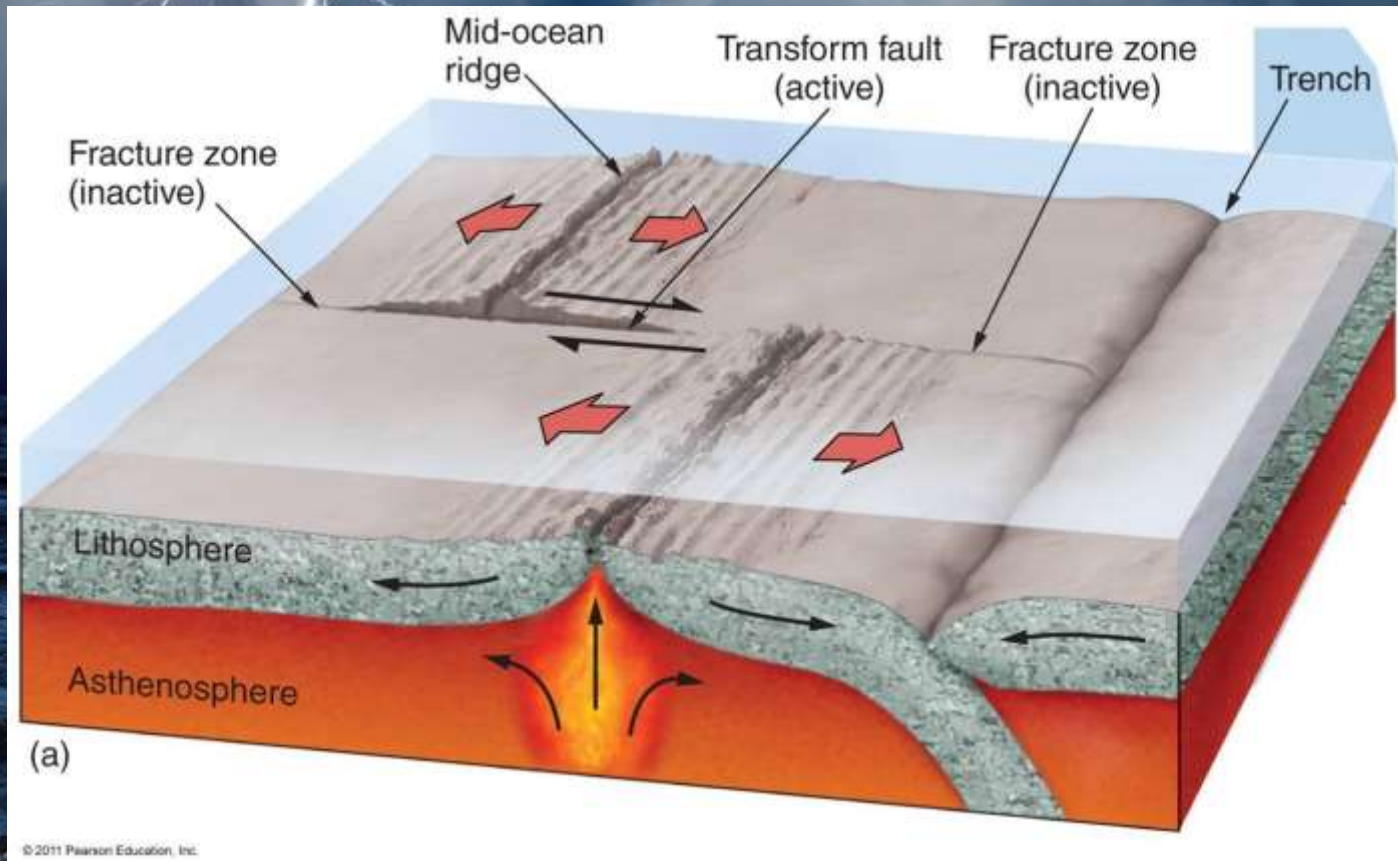


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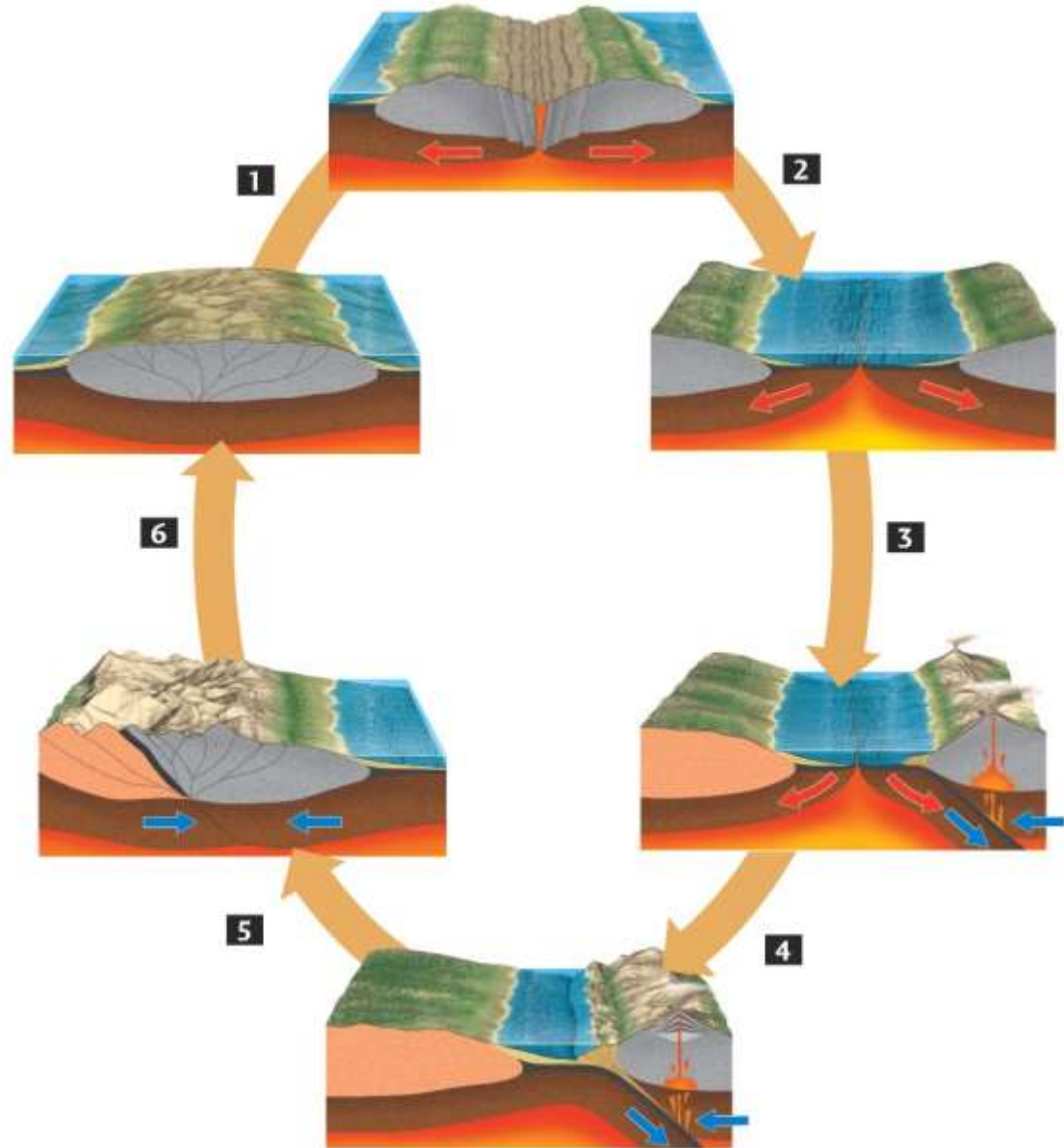
# Mid-ocean Ridge

Is a broad linear swell called a **rise** that is formed along well-developed divergent plate boundaries.



# The Wilson Cycle

- The cycle of opening and closing of Ocean Basins
- In plate tectonic theory, plates rift into pieces, diverging apart and new ocean basins are born.
- Followed by motion reversal, and plates converging back together, with plate collision and mountain building.

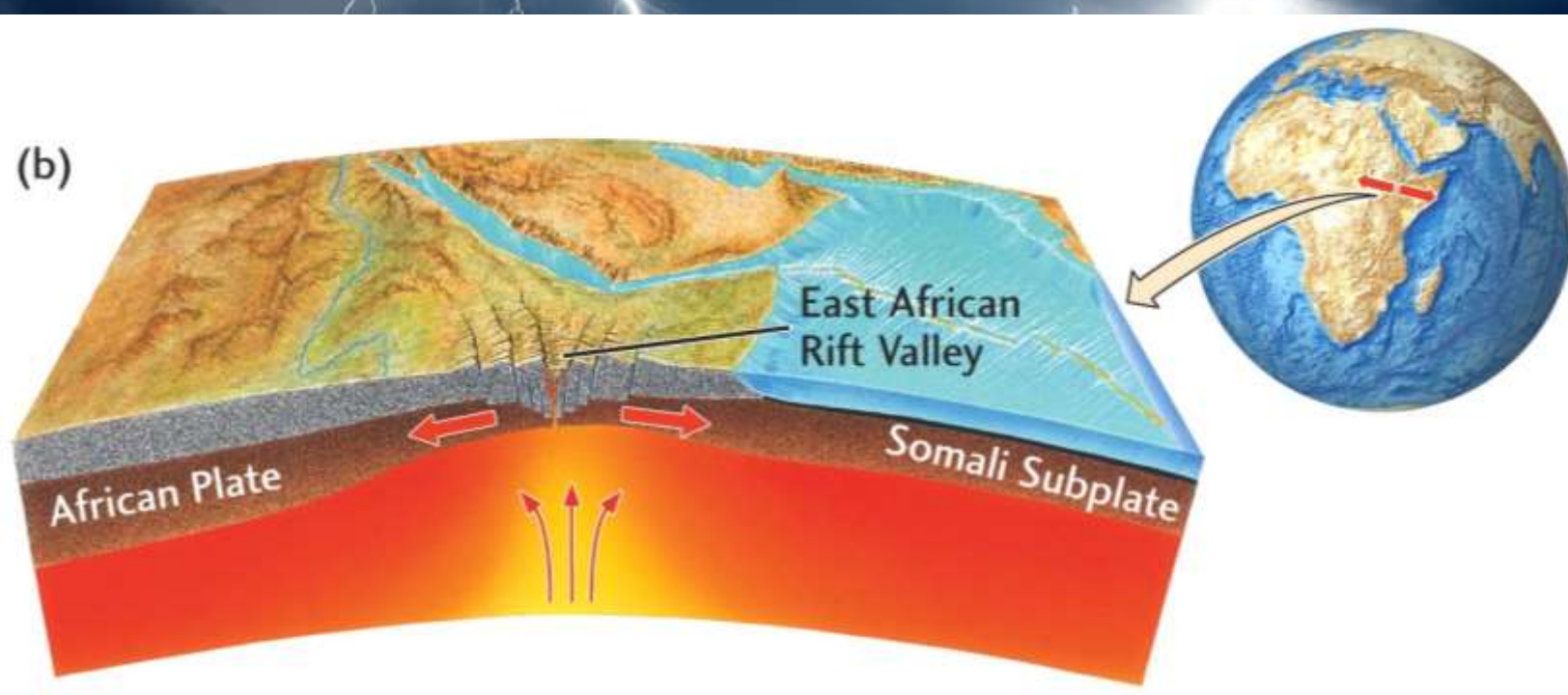
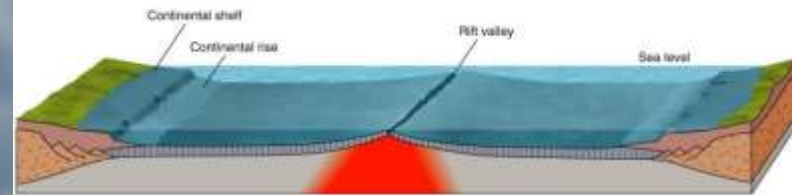
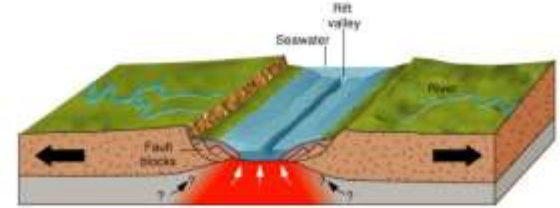


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# Act 1 Scene 1: Birth

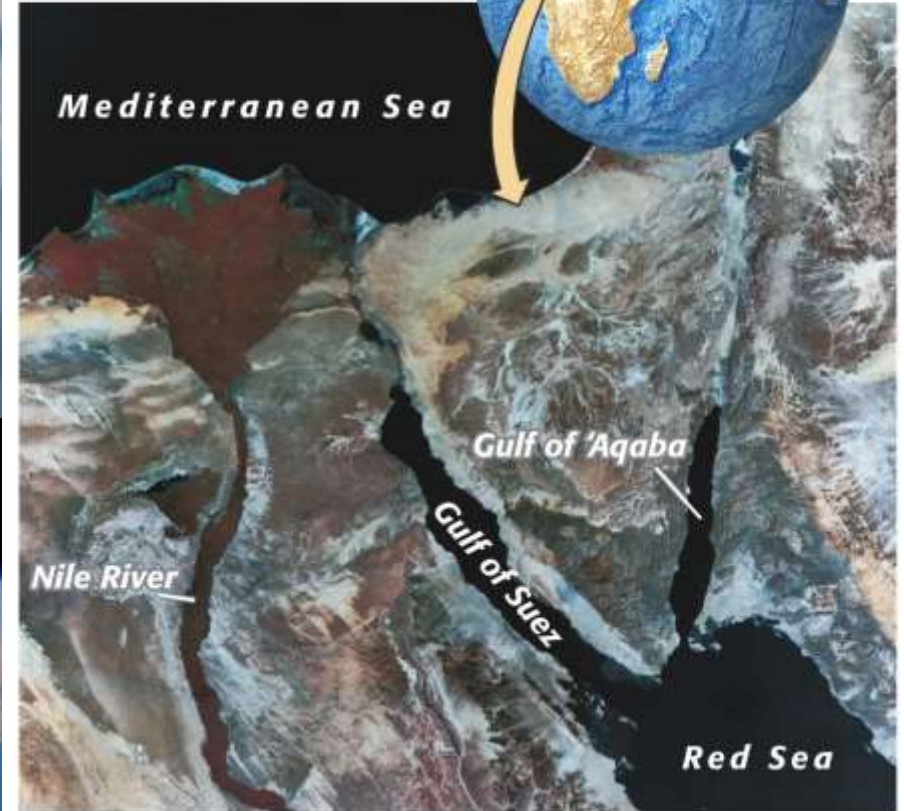
## Continental Rifting Eg. East African Rift Zone



# Act 1 Scene 2: Youth

Narrow Ocean Basin  
Eg. The Red Sea

(a)



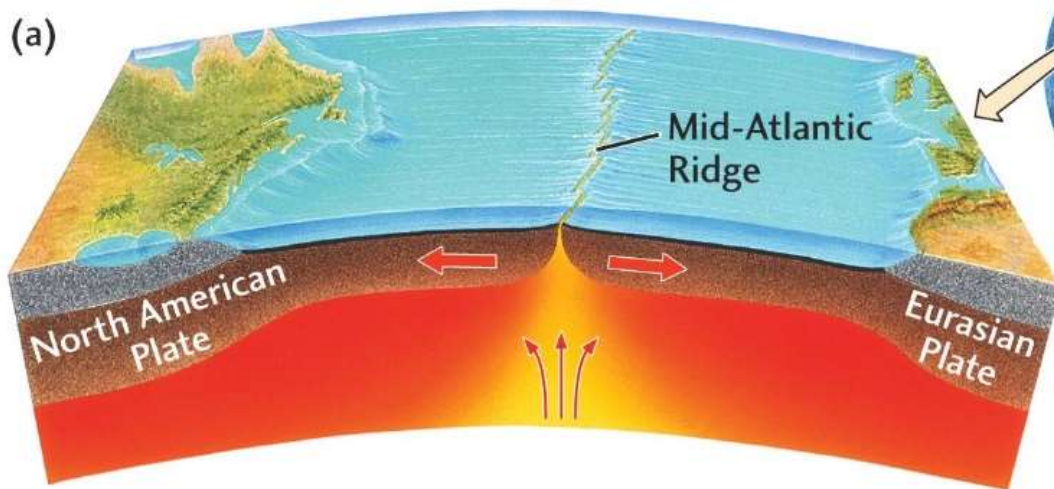
# Act 1 Scene 3: Adolescence

Maturing Ocean  
Basin

Eg. Atlantic Ocean

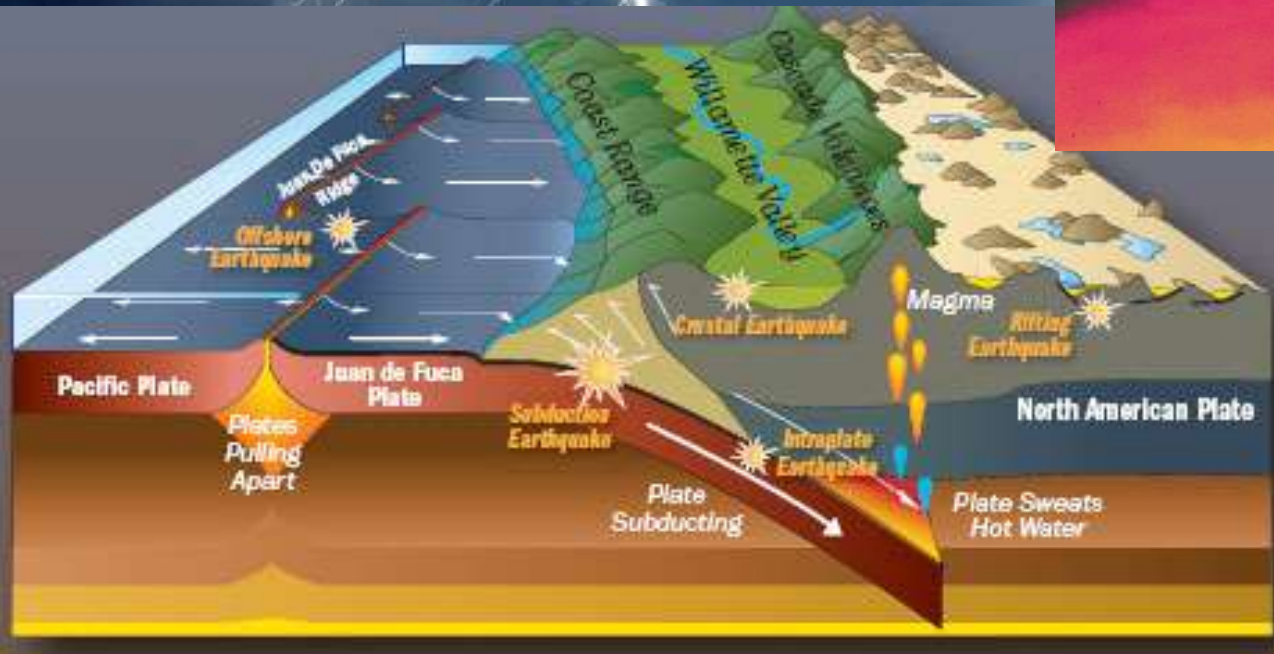
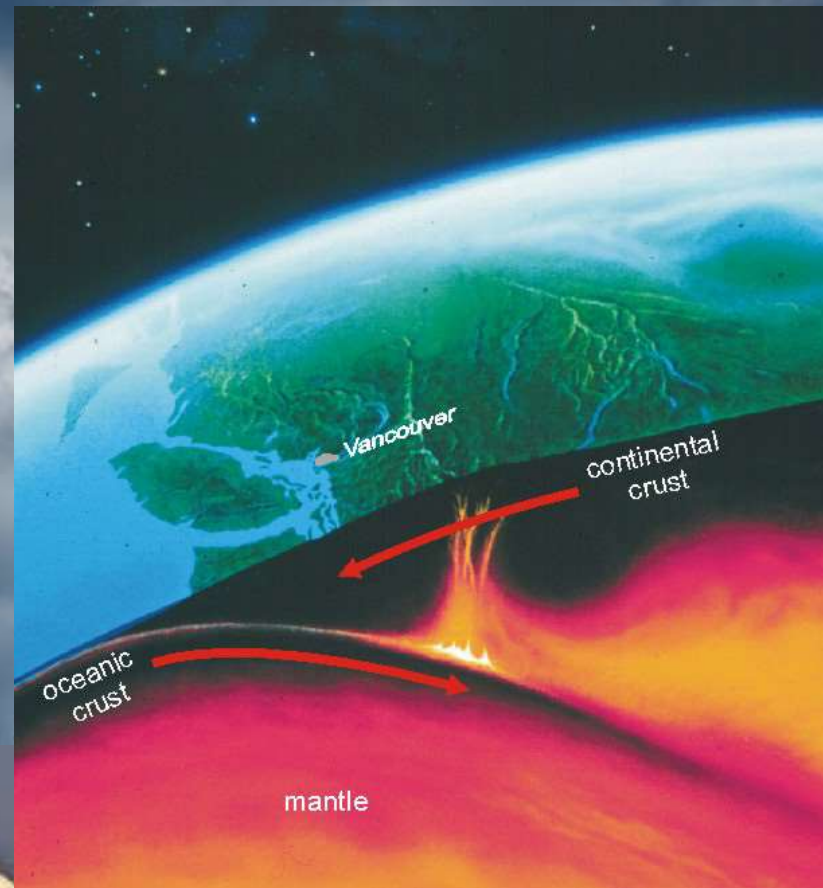


(a)



# Act 2 Scene 1: Maturity

Subduction at Basin  
Margins  
Eg. Pacific Ocean





# Act 2 Scene 2: Old Age



Subduction  
Dominates, Basin  
Narrows  
Eg. Mediterranean  
Sea

# Act 2 Scene 3: Death

Continental Collision, Closing of the  
Ocean Basin  
Eg. Tethys Sea

