
بسم الله الرحمن الرحيم

GEO 435

Oceanography

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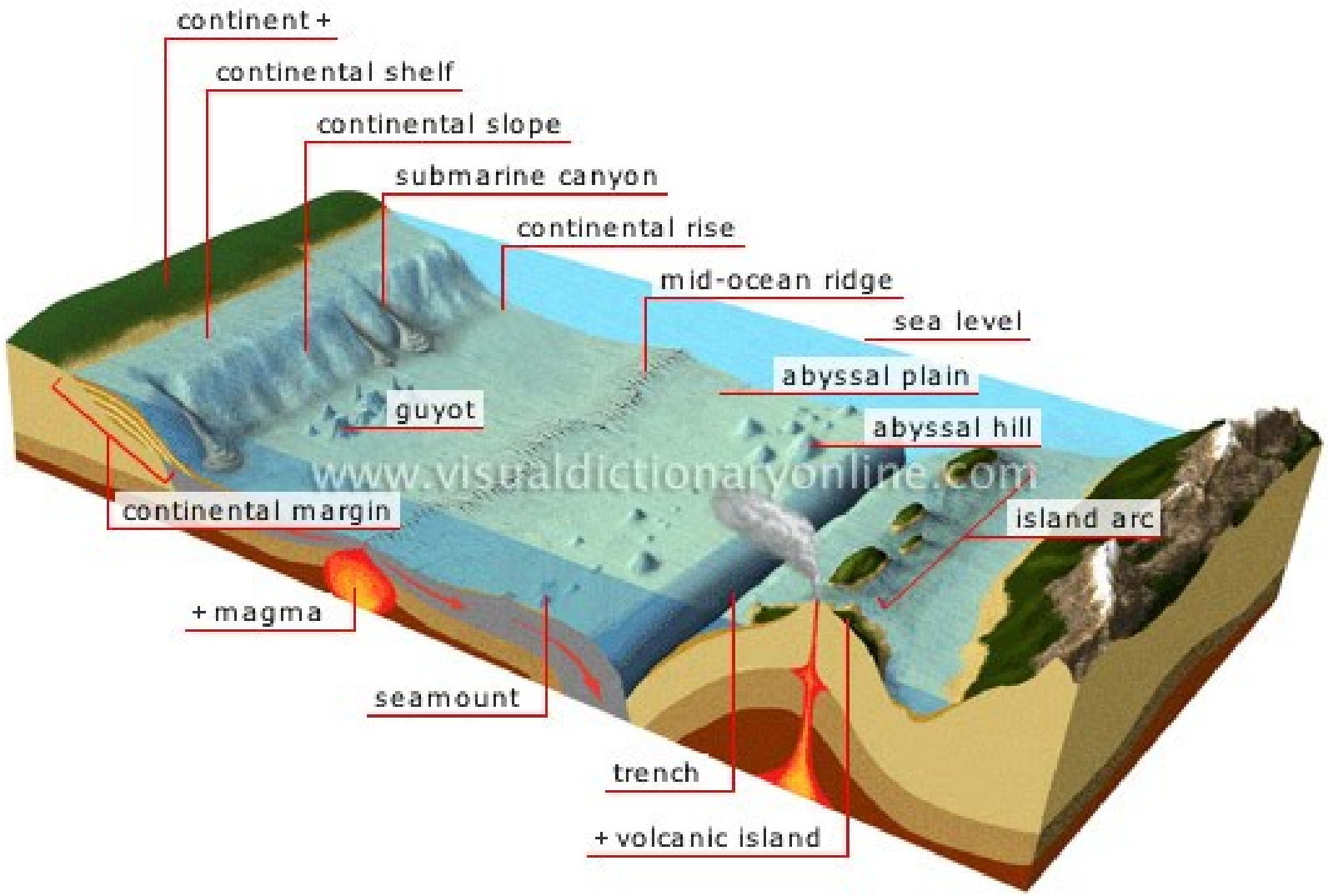
Marine Provinces:

- Ocean floor:
  - Continental margins:
    - Passive margins.
    - Active margins:
      - Convergent active margins.
      - Transform active margins.
  - Deep-ocean basins.
  - Mid-ocean ridge.
- Turbidity currents.
- Hydrothermal vents.
- Fracture zones and transform faults.



GEO 435 – Marine Provinces

Ocean floor is the bottom of the ocean

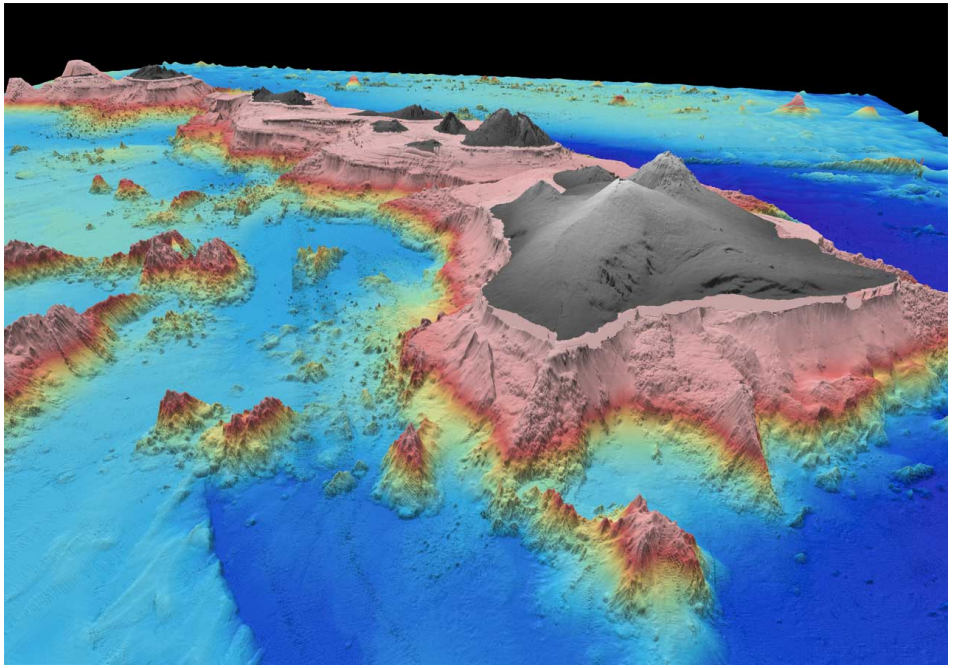
[Ocean floor = seafloor = sea floor = seabed]

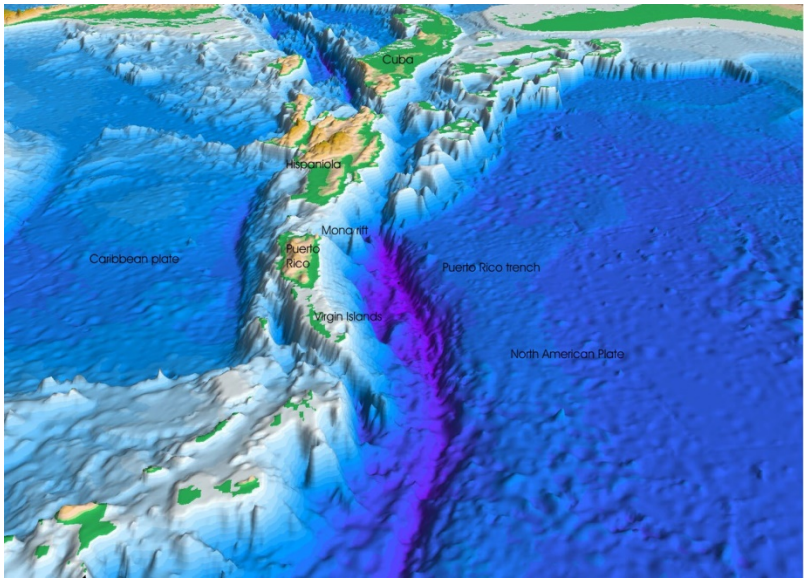
Q. How do scientists collect information about the depth and shape of the sea floor?

Bathymetry

(bathy= depth, metry=measurement)

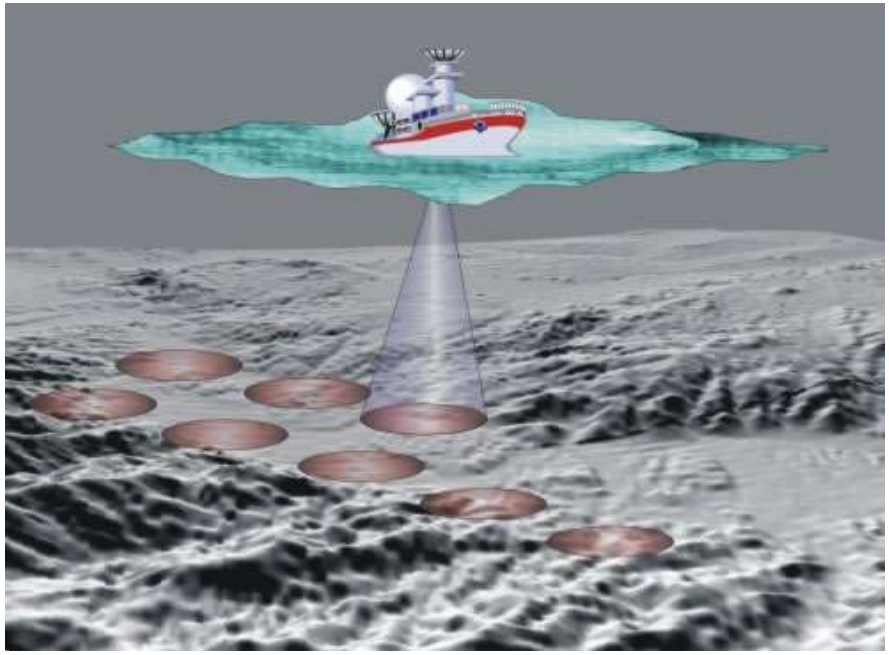
Bathymetry is the measurement of ocean depths and the charting of the shape or topography of the ocean floor.





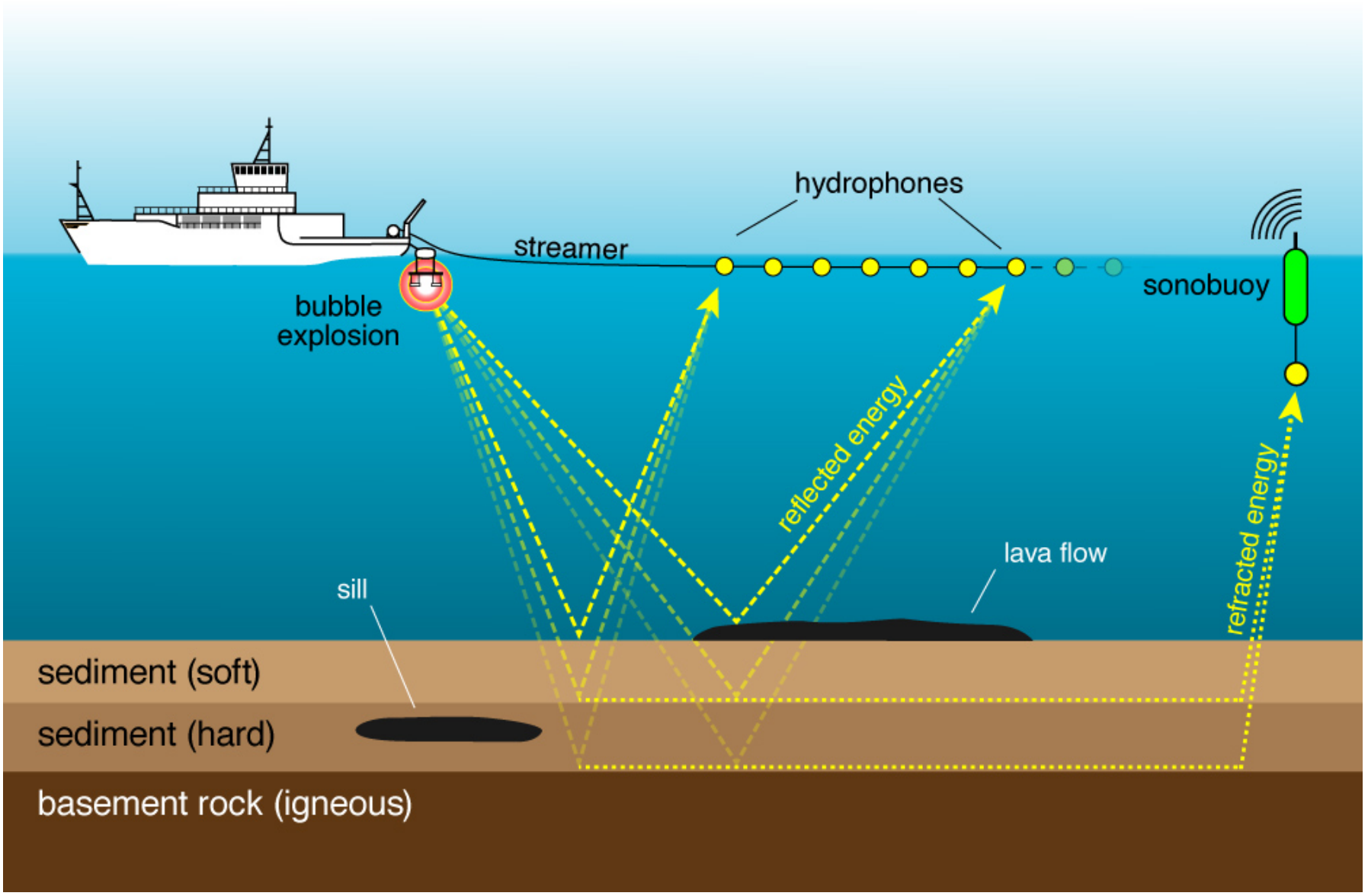
Echo sounding

- An echo sounder sends a sound signal called ping into the ocean to produce echoes when the sound bounces off any density difference.
- Today, sonar give more precise picture of the ocean floor.



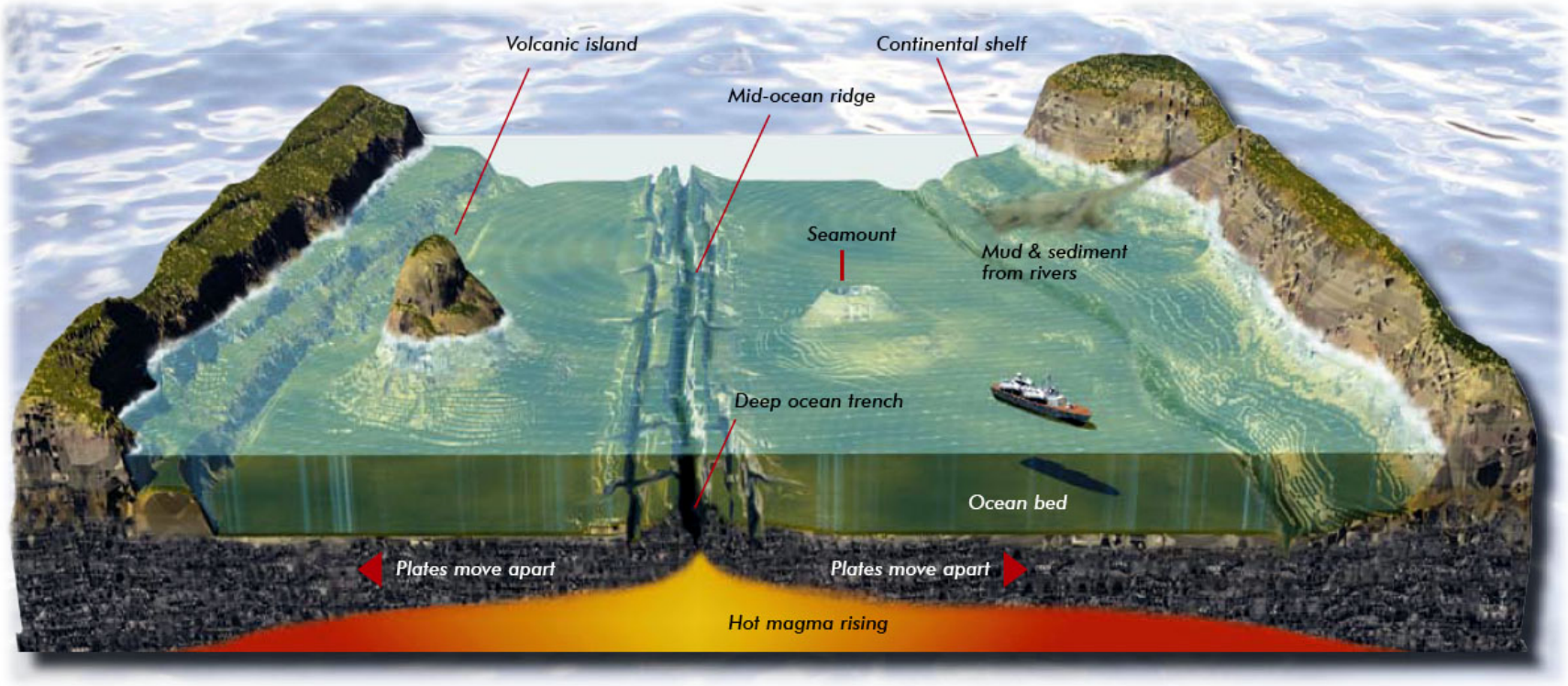
Seismic reflection profiles

- Oceanographers who want to know about ocean structure beneath the sea floor use strong low-frequency sounds produced by explosions or Air guns.
- These sounds penetrate beneath the sea floor and reflect off the boundaries between different rock or sediment layers, producing seismic reflection profiles, which have applications in mineral and petroleum exploration.


hydrophones
streamer
sonobuoy
bubble
explosion
reflected energy
refracted energy
lava flow
sill
sediment (soft)
sediment (hard)
basement rock (igneous)

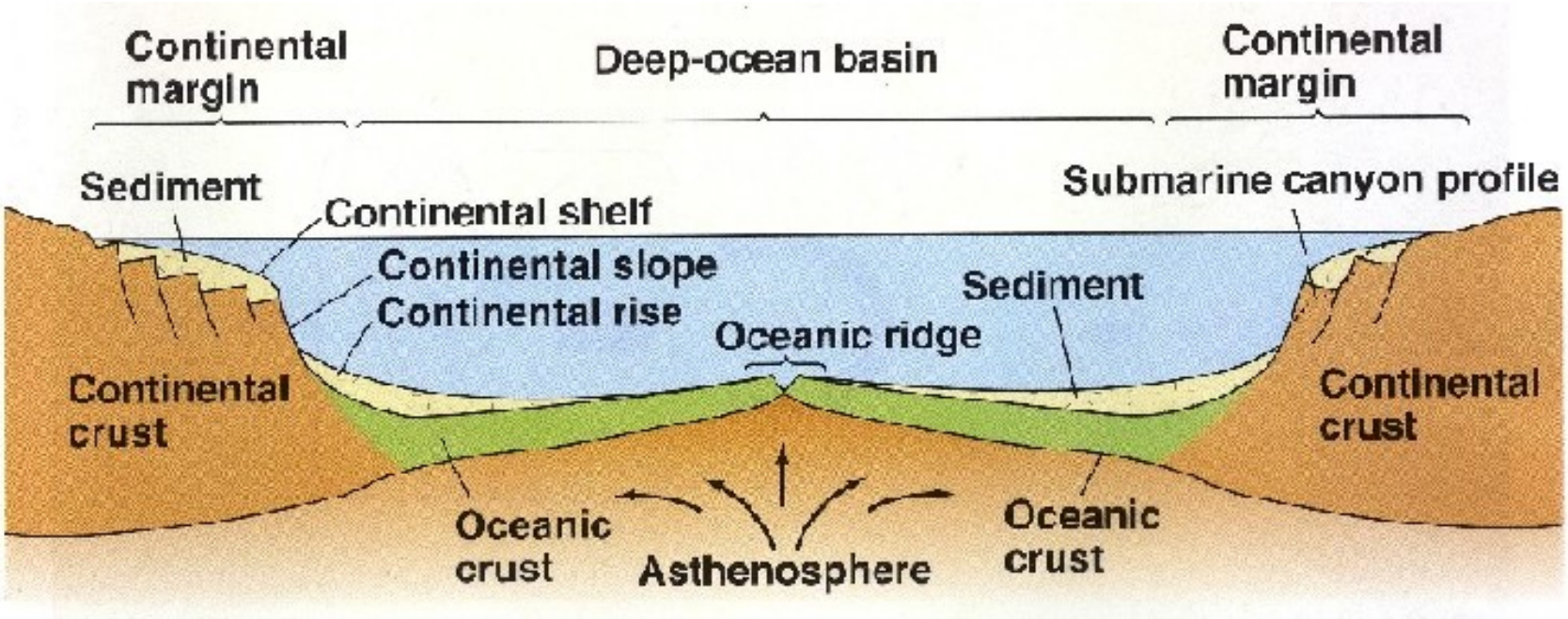
Divisions of ocean floor:

1. Continental margins.
2. Deep-ocean basins.
3. Mid-ocean ridge.



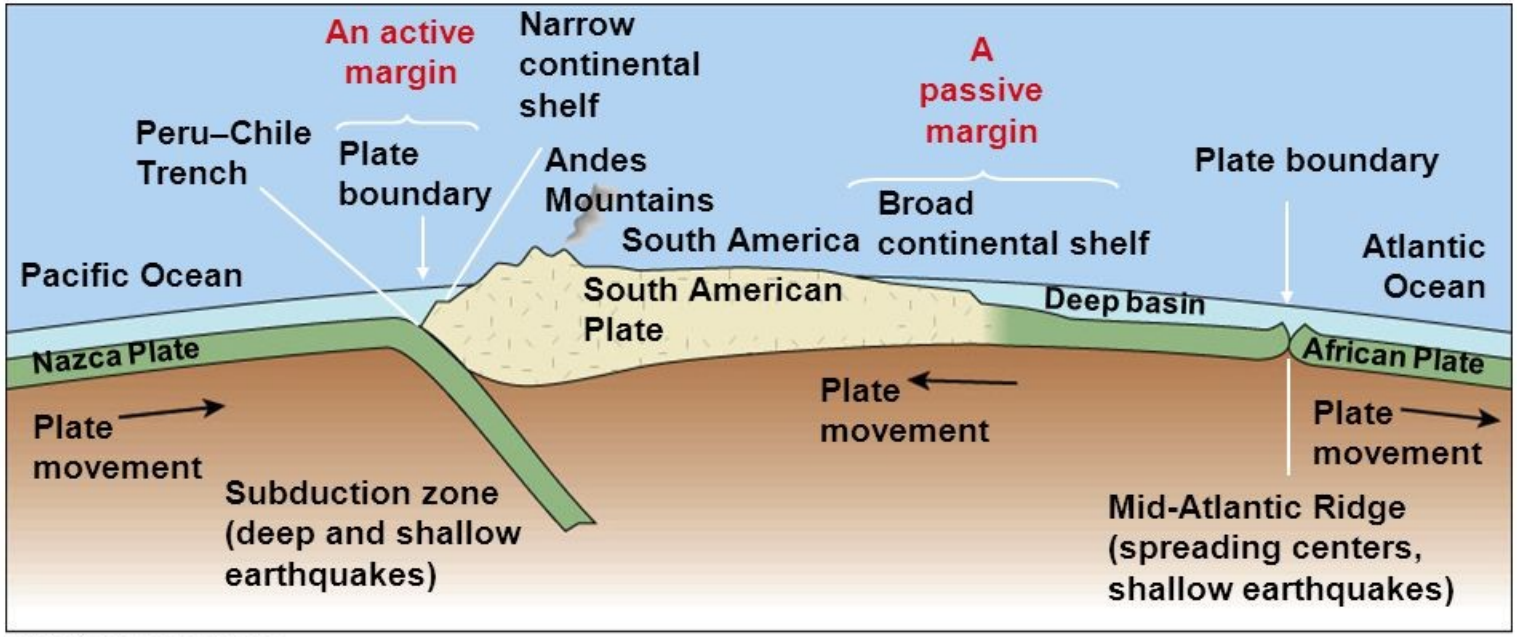
Continental margins

- Continental margins are shallow-water are close to continents.
- The continental margin is the zone of the ocean floor that separates the thin oceanic crust from thick continental crust.



Classifications of continental margins

1. Passive margins: is the transition between oceanic and continental crust which is not an active plate margin.
2. Active margins: Active continental margins are those that are tectonically active, such as along much of the Pacific coast.
    1. Convergent active margins.
    2. Transform active margins.



- Atlantic = Passive Margin

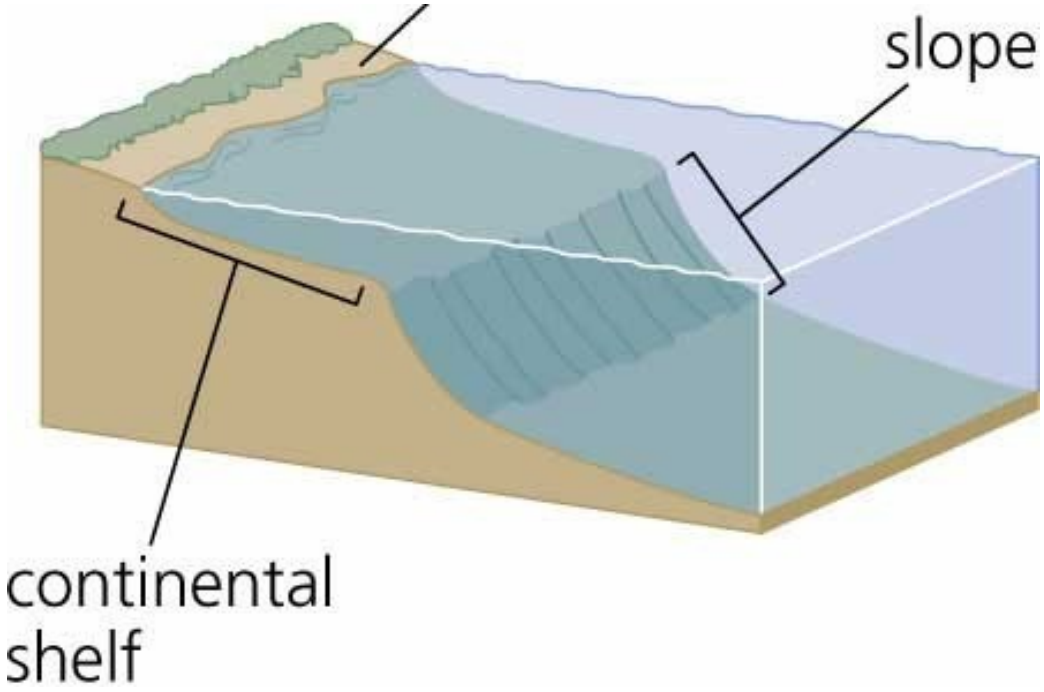
  little/no geologic activity

- Pacific = Active Margin

  geologic activity

Continental shelf

Continental shelf is a flat zone extending from the shore beneath the ocean surface to a point at which a marked increase in slope angle occur, called the shelf break.

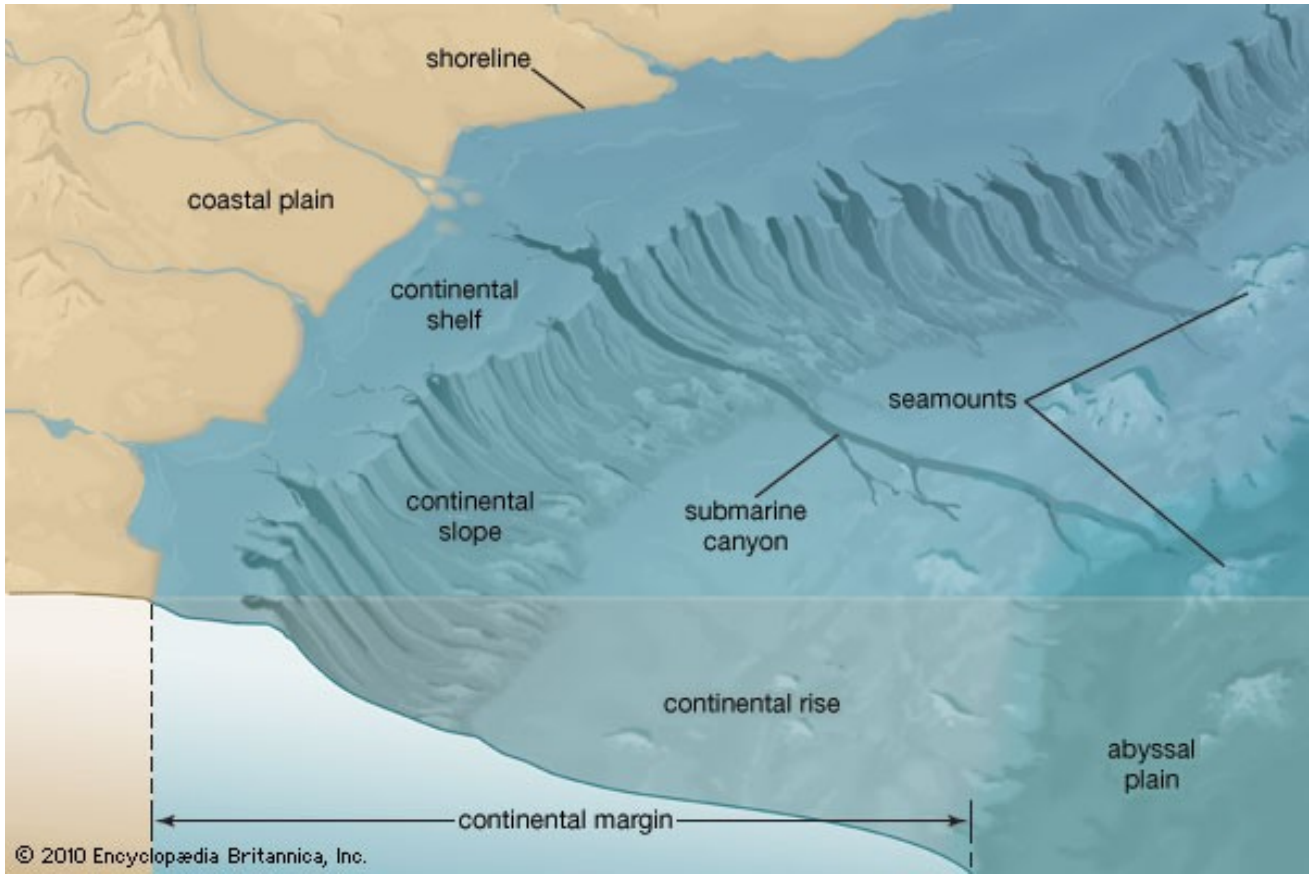


Continental slope

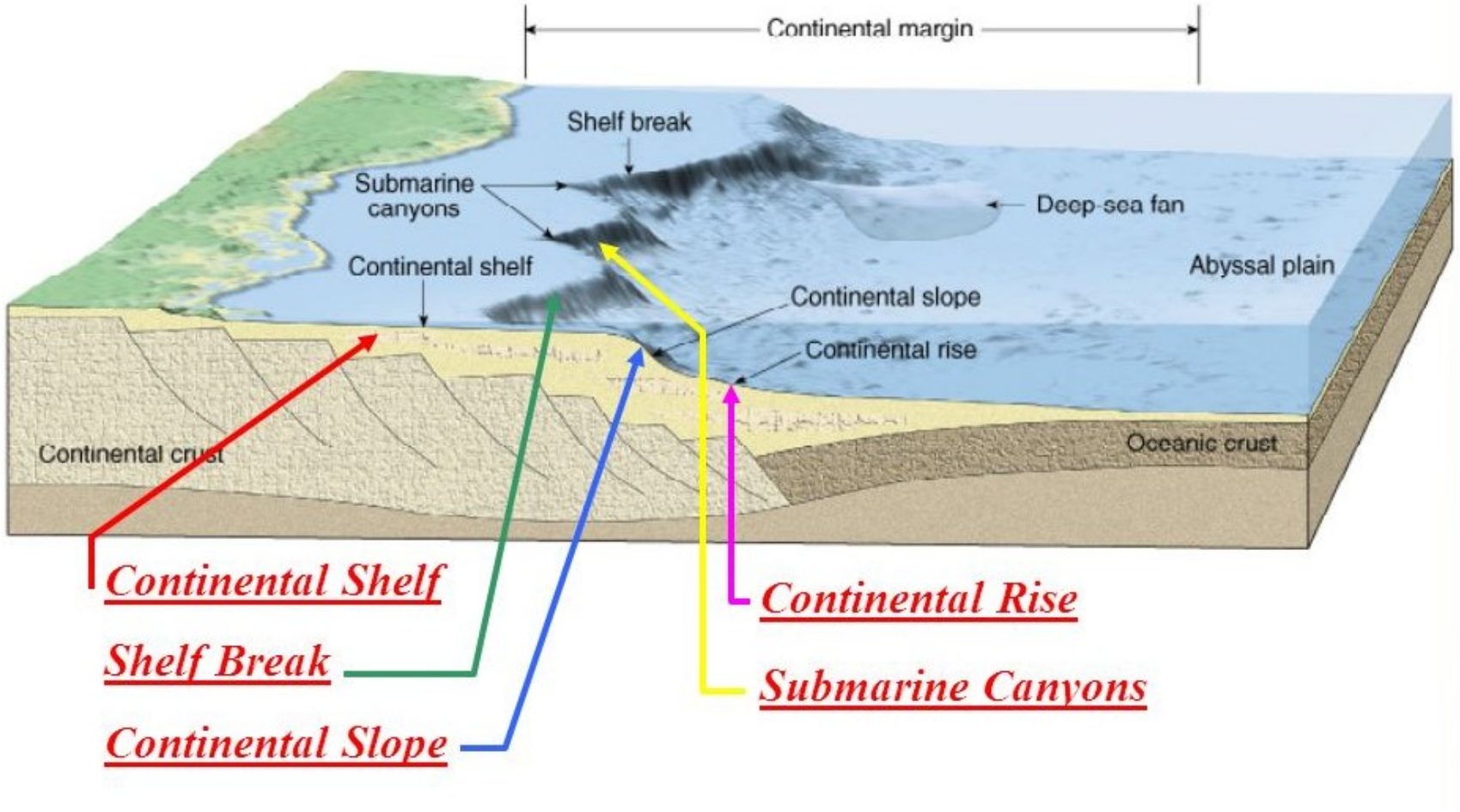
Continental slope is where the deep-ocean basins begin.

Continental rise

Continental slope is a transition zone between the continental margin and the deep-ocean floor.

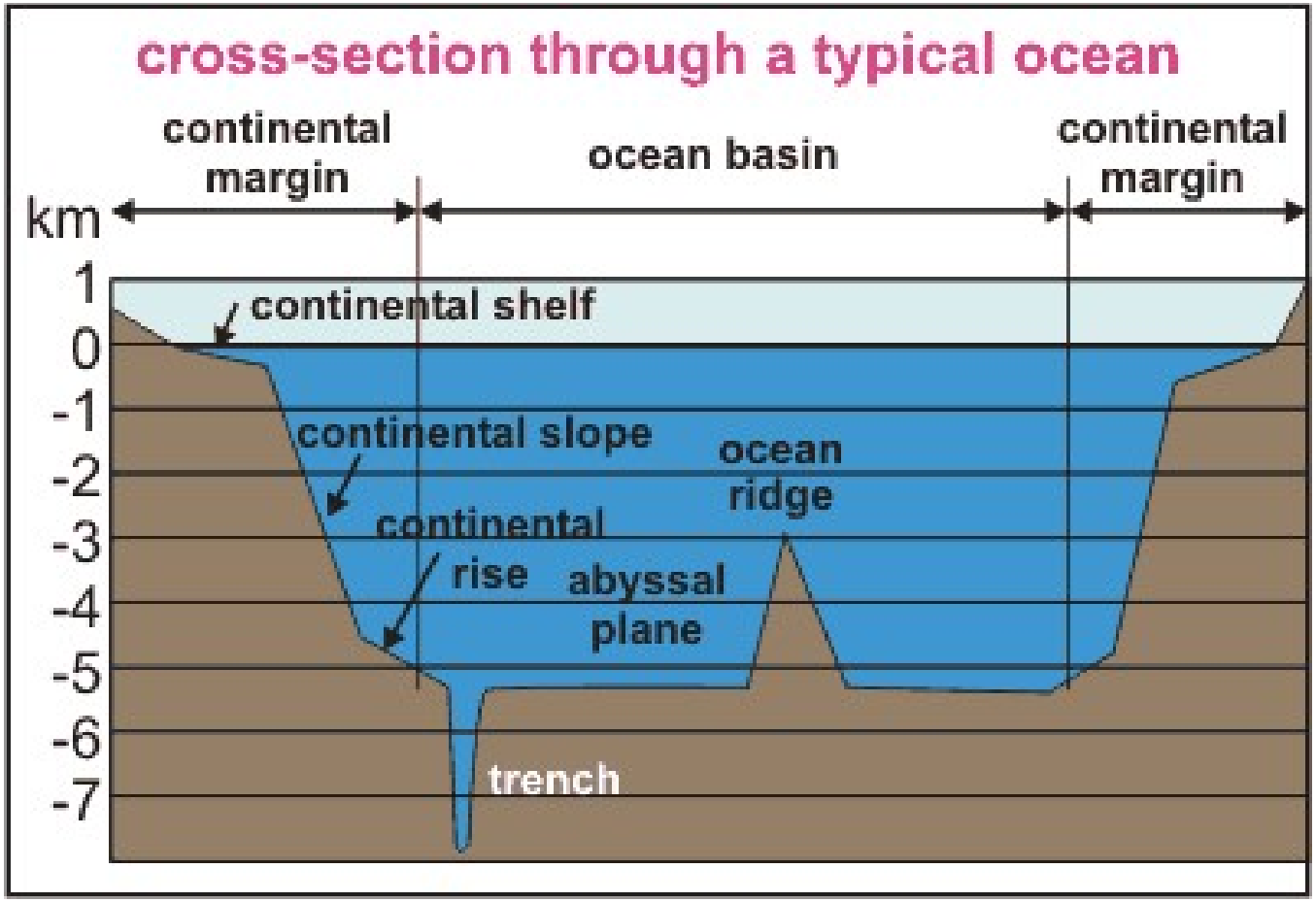


CONTINENTAL MARGINS



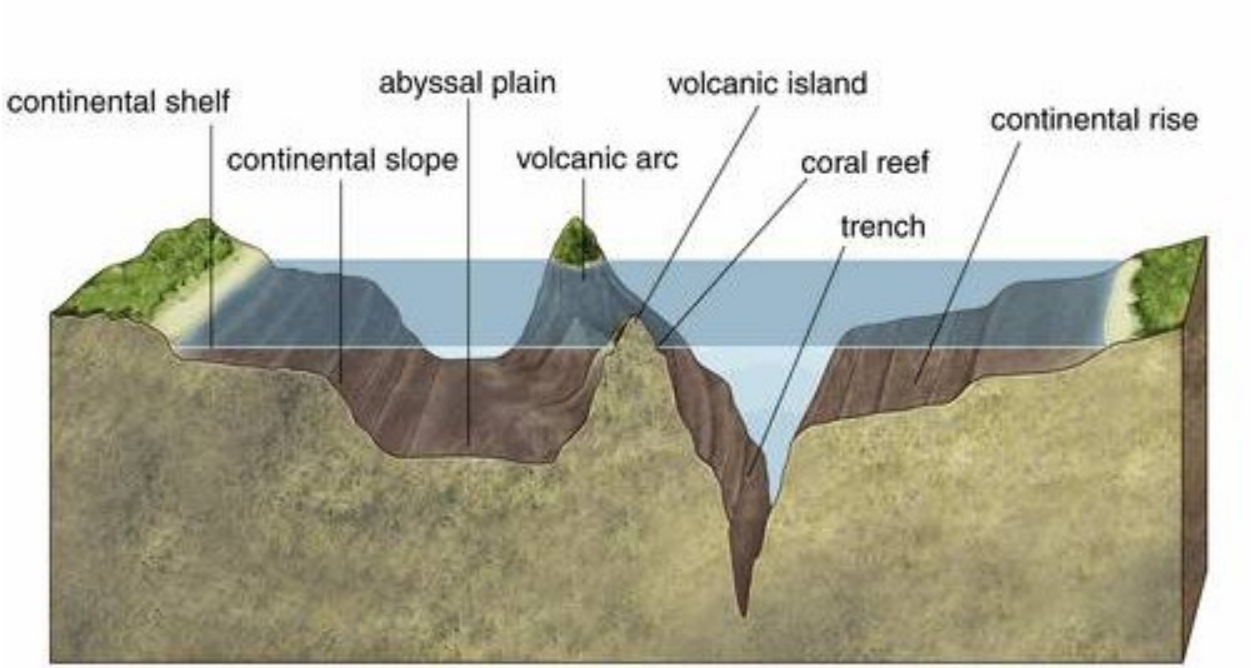
Ocean basin

Ocean basins are large geologic basins that are below sea level.



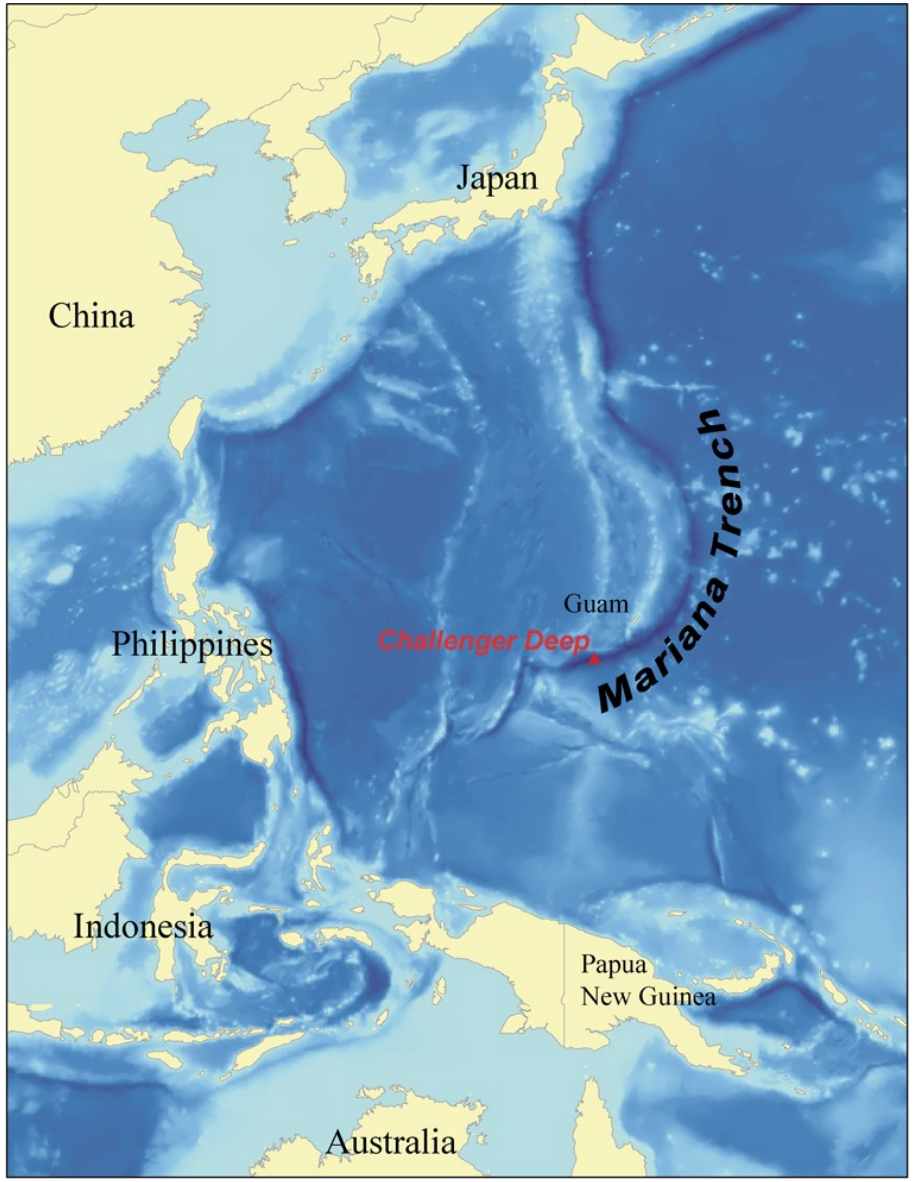
Oceanic trench

- Ocean trench is a narrow topographic depressions of the sea floor.
- It is caused by the collision of two plate along convergent plate margins.
- They are also the deepest parts of the ocean floor.



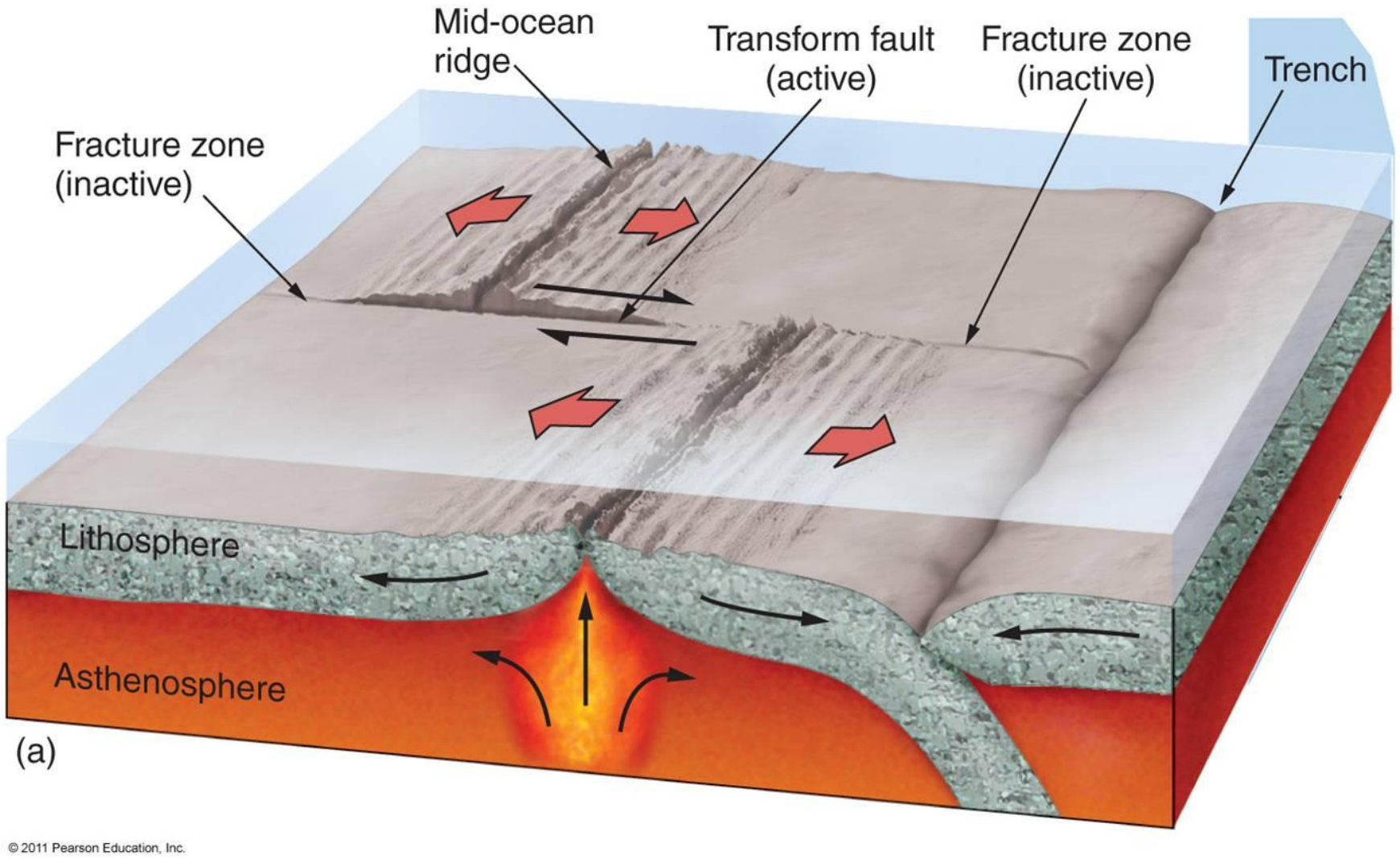
Deepest trench

- The Mariana Trench or Marianas Trench is the deepest part of the world's oceans. It is located in the western Pacific Ocean, to the east of the Mariana Islands
- It reaches a maximum-known depth of 10.911 km.



Mid-oceanic ridge

- A mid-ocean ridge is a general term for an underwater mountain system that consists of various mountain ranges (chains) formed by plate tectonics.
- This type of oceanic ridge is characteristic of what is known as an oceanic spreading center, which is responsible for seafloor spreading.


Mid-ocean ridge
Transform fault (active)
Fracture zone (inactive)
Trench
Fracture zone (inactive)
Lithosphere
Asthenosphere
(a)
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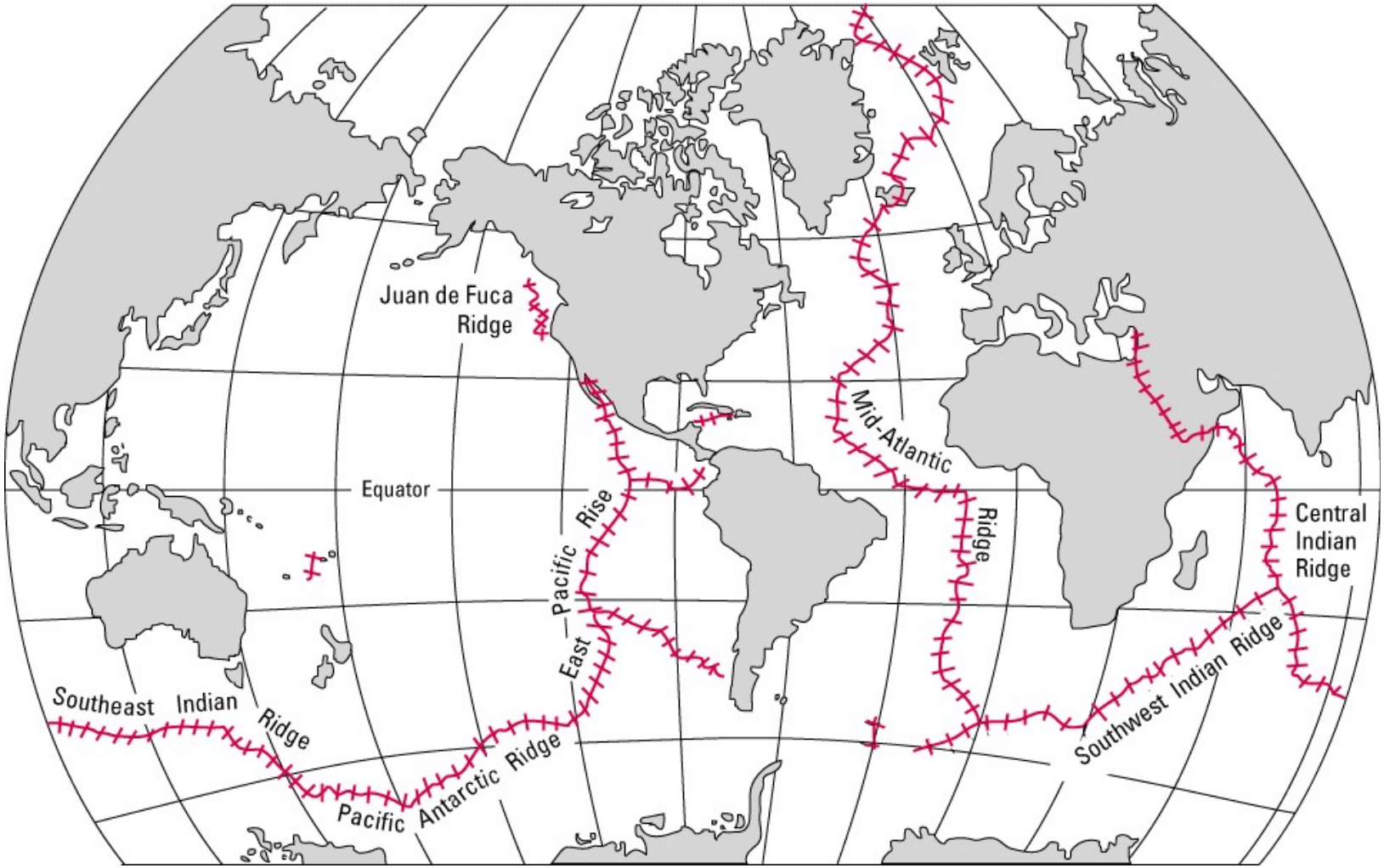
Q. Where are the mid-oceanic ridges?



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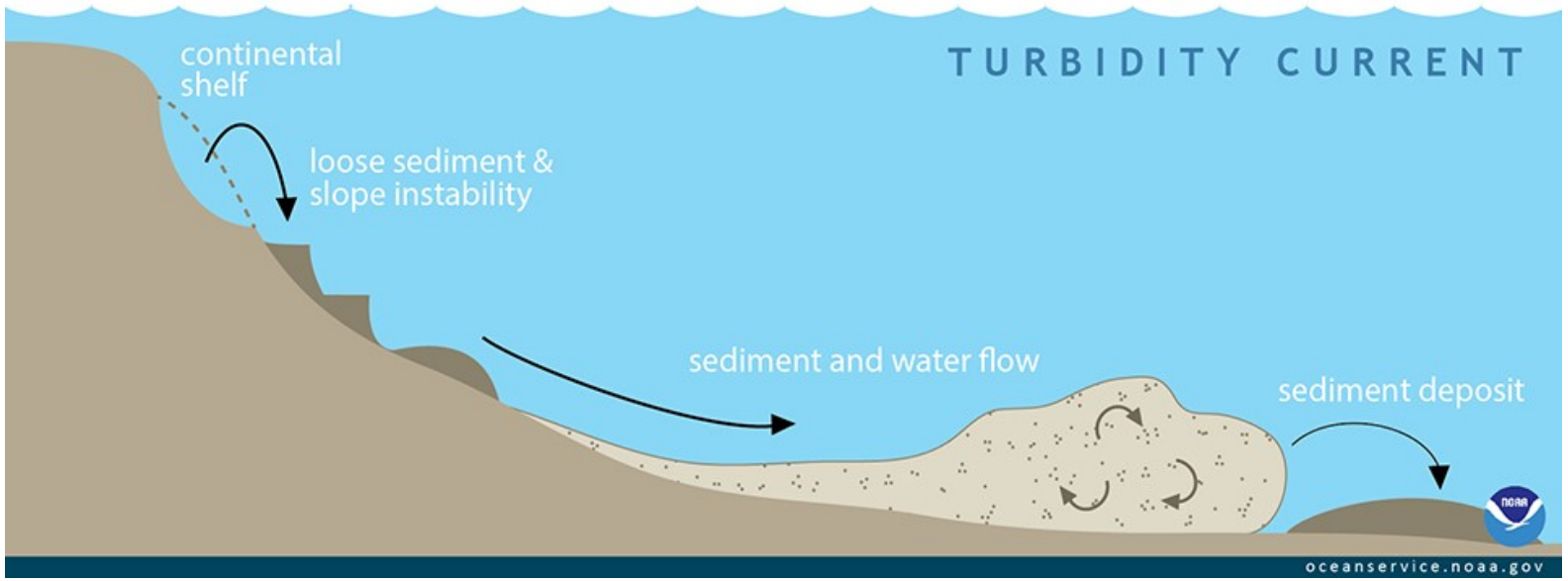
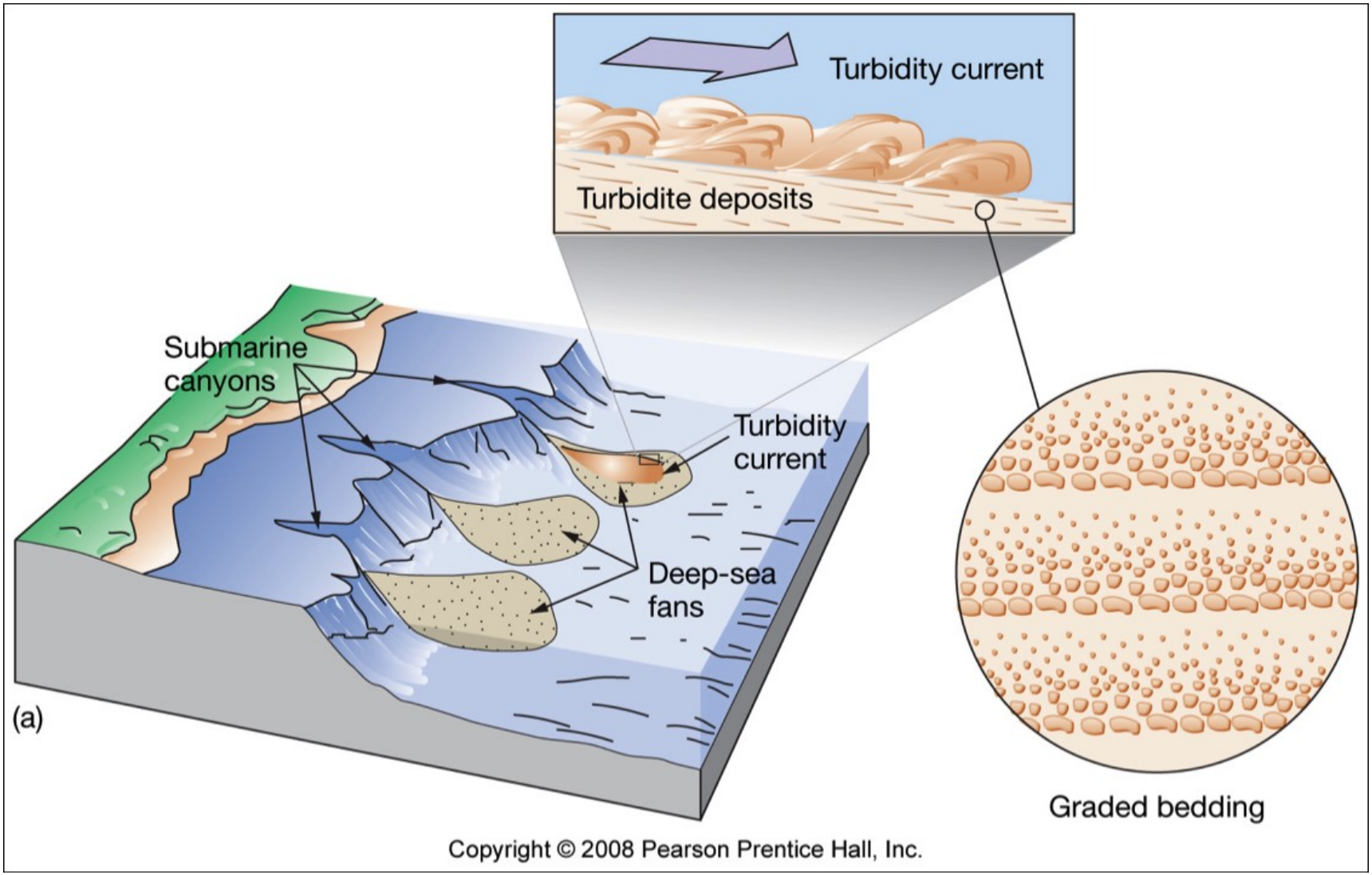
Turbidity currents

Turbidity currents are underwater avalanches of muddy water mixed with rocks and other debris.




Turbidity current
Turbidite deposits
Submarine canyons
Turbidity current
Deep-sea fans
(a)
Graded bedding
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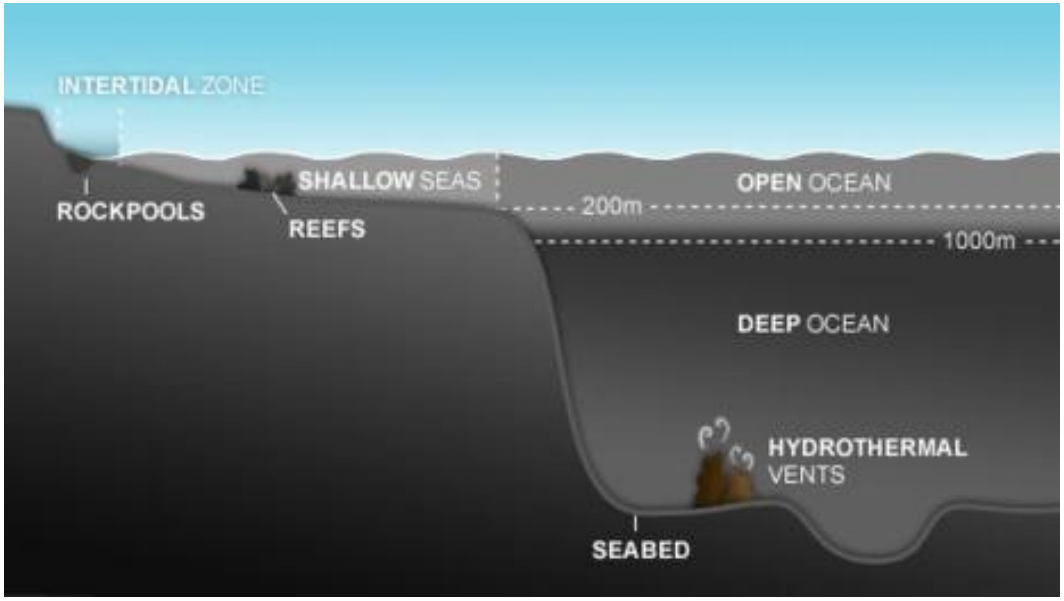
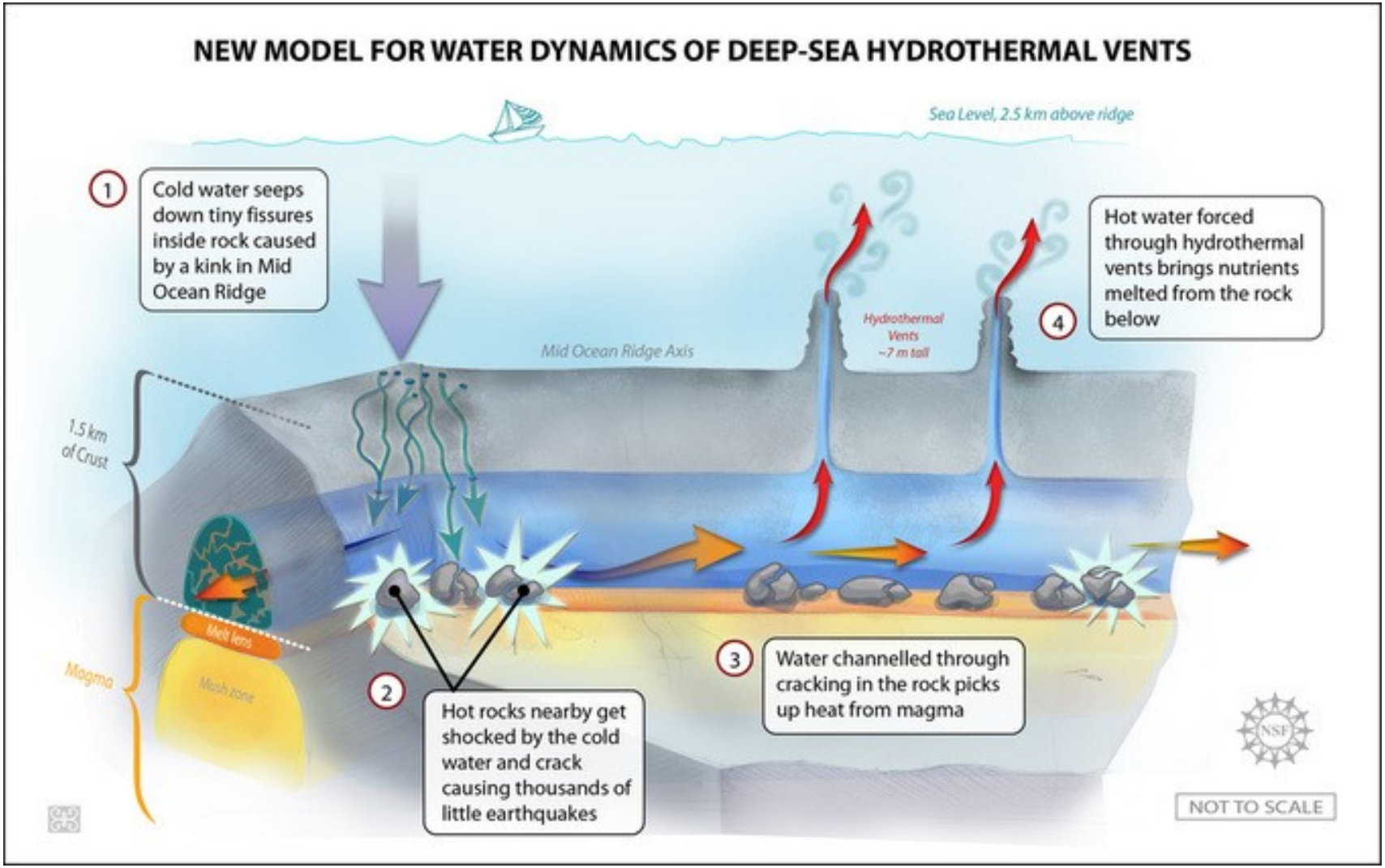
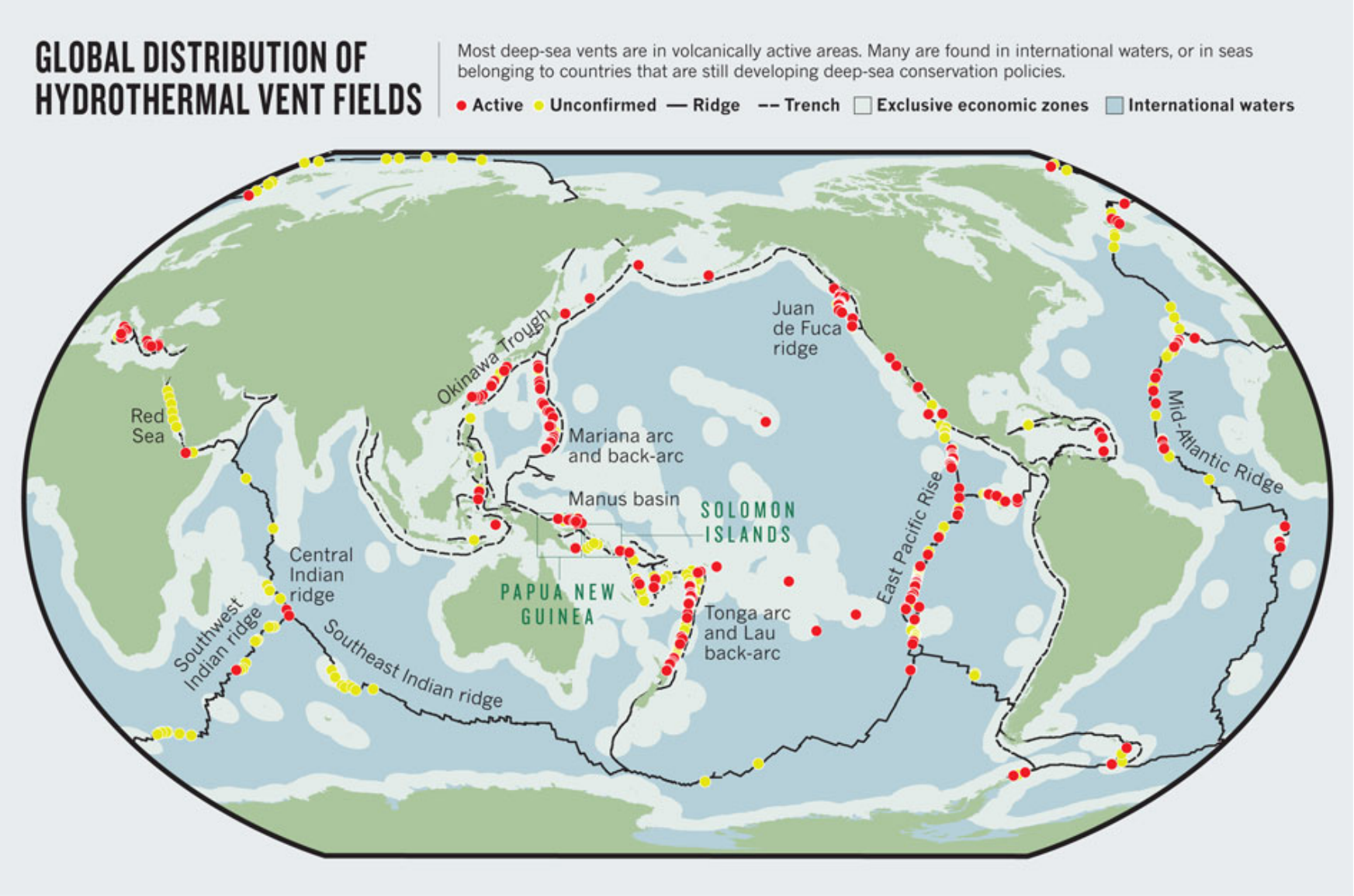
Hydrothermal vents

- A hydrothermal vent is a fissure in a planet's surface from which geothermally heated water issues.
- Hydrothermal vents are commonly found near volcanically active places, areas where tectonic plates are moving apart, ocean basins, and hotspots.




NEW MODEL FOR WATER DYNAMICS OF DEEP-SEA HYDROTHERMAL VENTS
Sea Level, 2.5 km above ridge
1
Cold water seeps down tiny fissures inside rock caused by a kink in Mid Ocean Ridge
Mid Ocean Ridge Axis
Hydrothermal Vents ~7 m tall
4
Hot water forced through hydrothermal vents brings nutrients melted from the rock below
1.5 km of Crust
Magma
Melt lens
Mush zone
2
Hot rocks nearby get shocked by the cold water and crack causing thousands of little earthquakes
3
Water channelled through cracking in the rock picks up heat from magma
NSF
NOT TO SCALE



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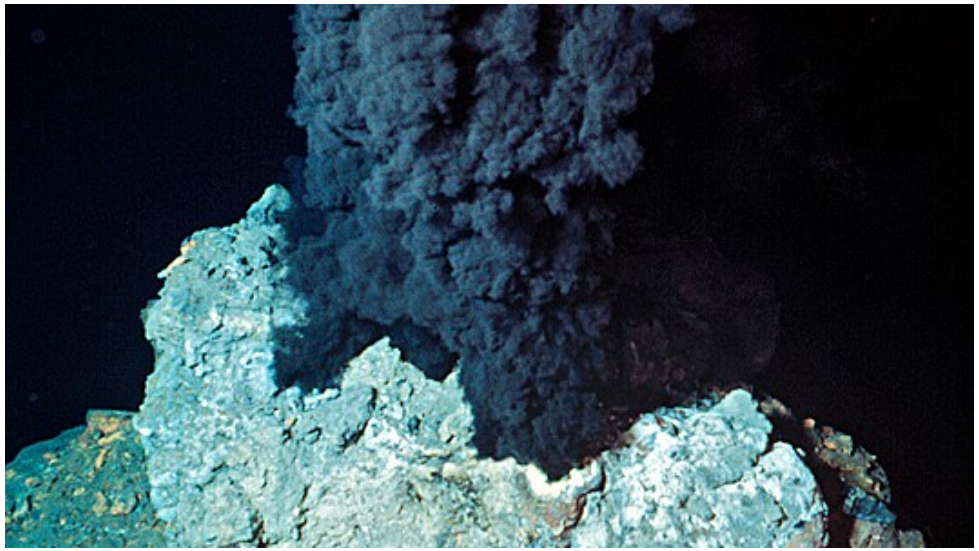
Q. Why hydrothermal vents have black smokes?

Because of the presence of dark-colored metal sulfides which includes iron, nickel, and zinc.



Fracture zone & transform faults

- The mid-ocean ridge is cut by a number of transform faults, which offset spreading zones.
- A fracture zone is a linear oceanic feature--often hundreds, even thousands of kilometers long--resulting from the action of offset mid-ocean ridge axis segments