

Ocean Basin

Chapter 3

Global elevations

- **continental crust : Thick and Lighter**
 - ◆ **Average height: 840 m**
- **oceanic crust : Thin and denser**
 - ◆ **Average depth: 3729 m**
- **Two different types of crust floating in the mantle (this is the concept of isostasy). Note that the mantle is solid rock, but it flows and deforms like a fluid on very long time scales.**

**Continental
Crust**

Oceanic crust

Mantle

Characteristics of the World Ocean

Area: 361,100,000 km² 71% of Earth's surface
139,400,000 mi²

Volume: 1,370,000,000 km³ 97% of Earth's
329,000,000 mi³ surface water

Average depth: 3,796 m (12,451 ft)

Average temperature: 3.9°C (39.0°F)

Average salinity: 34.482 ‰ (34.482 g/kg)
(0.56 oz/lb)

Nature of Coast Line

■ Active Margin

- ◆ Western Coast of USA
- ◆ Steep Continental Shelf
- ◆ Narrow beach
- ◆ Rocky cliffs

■ Passive Margin

- ◆ East Coast
- ◆ Wide, gentle beach, sandy offshore islands
- ◆ Broad Continental Shelf

The Coast of Oregon is Marked by Cliffs

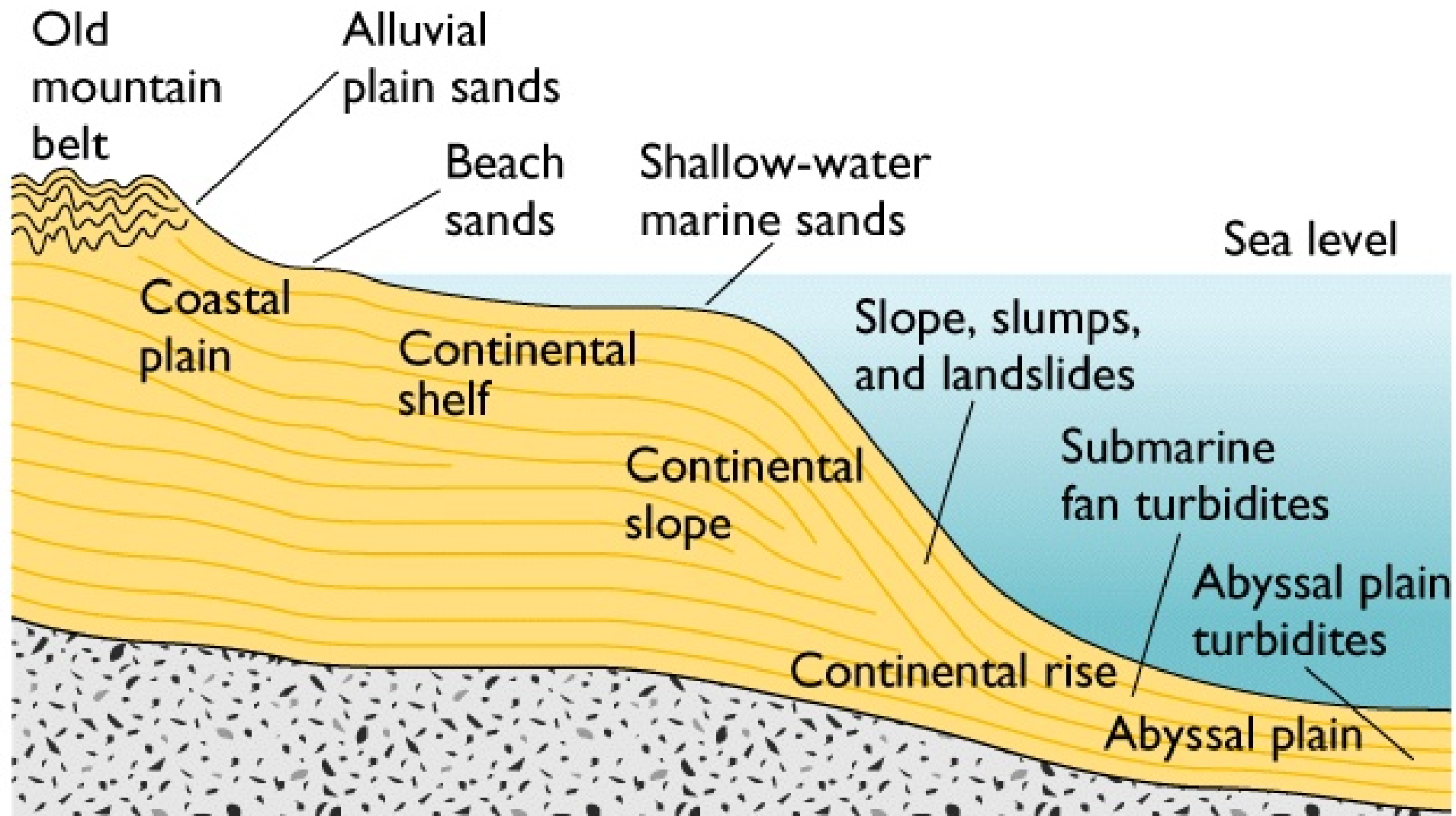




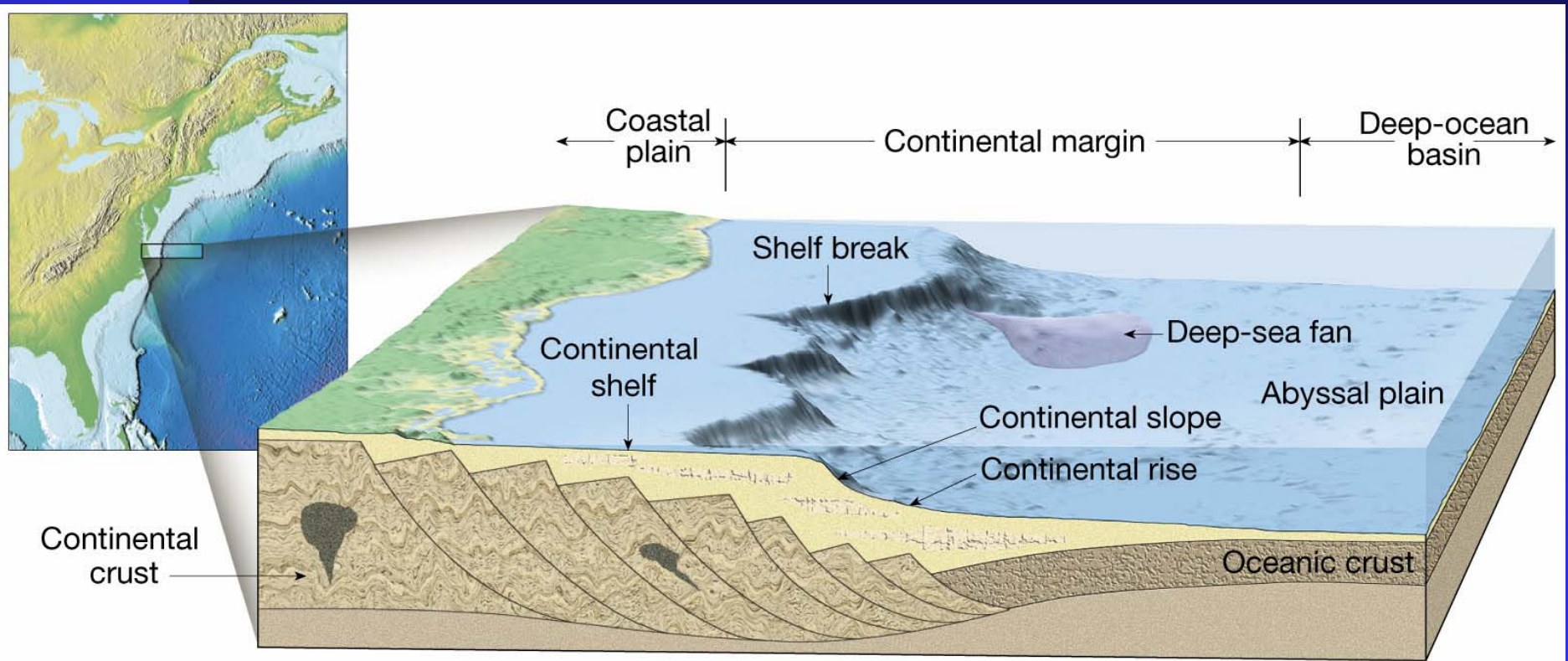
B

Ocean Profile

Continental Margin



Provinces of a passive continental margin



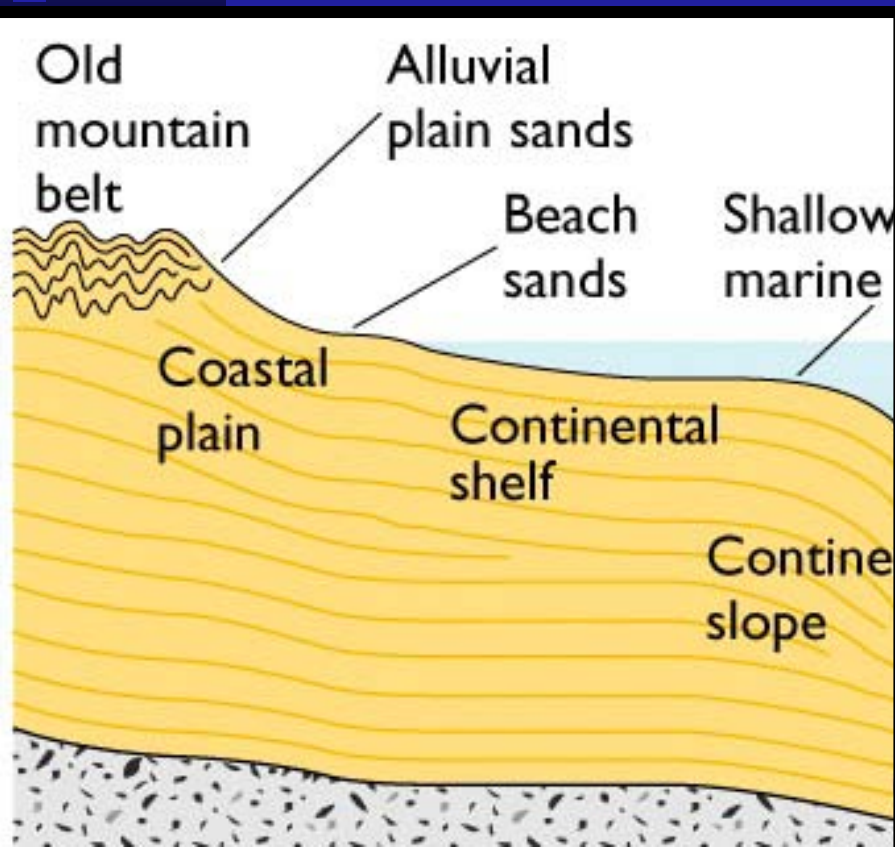
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Figure 13.7

Major features of the seafloor

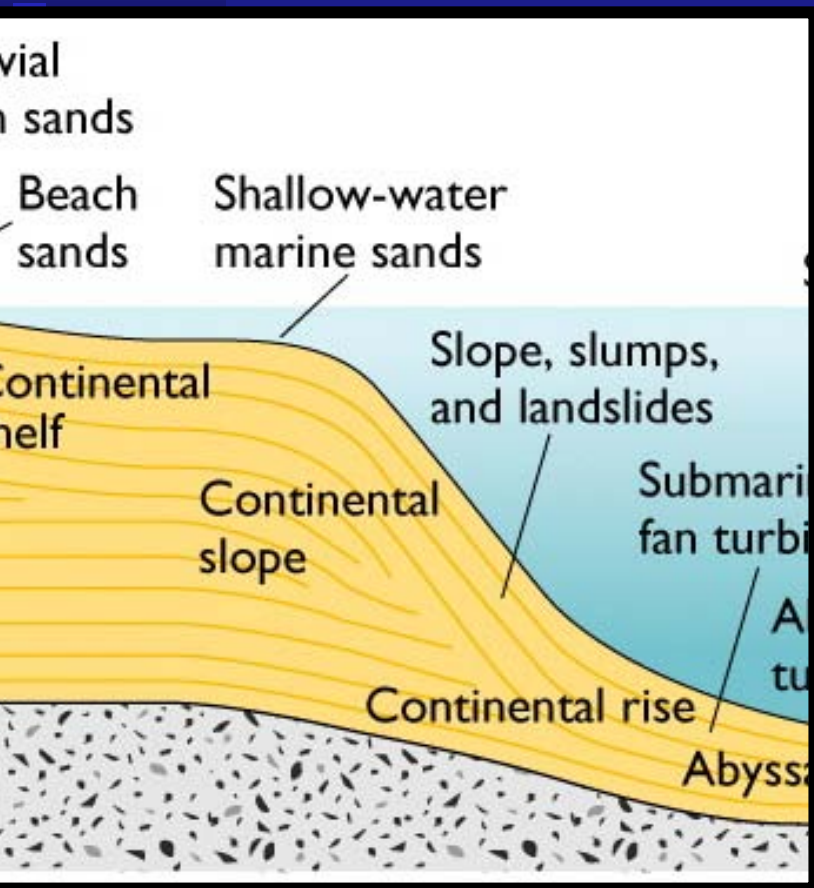
A. Continental shelf

- ◆ the seaward extension of the continents
- ◆ underlain by continental crust
- ◆ water depths are less than 400 m and generally less than 100 m.
- ◆ the seaward edge of the continental shelf marks the point of lowest sea level during the last maximum ice age, -- it was the beach!
- ◆ Ranges in width from a few km (such as off our eastern shore here in Miami) to 400 km (such as in the Arctic Ocean).



Major features of the seafloor

Continental slope



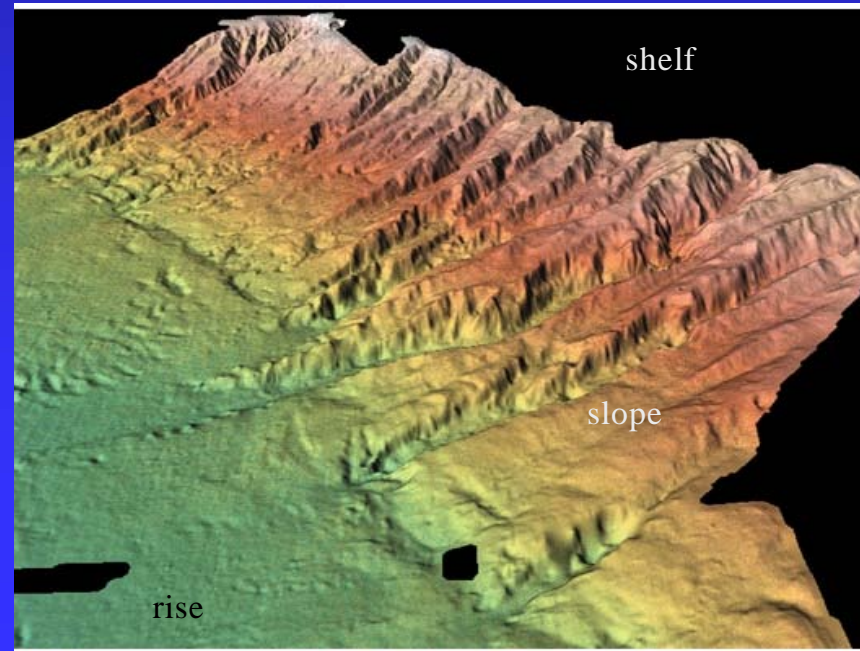
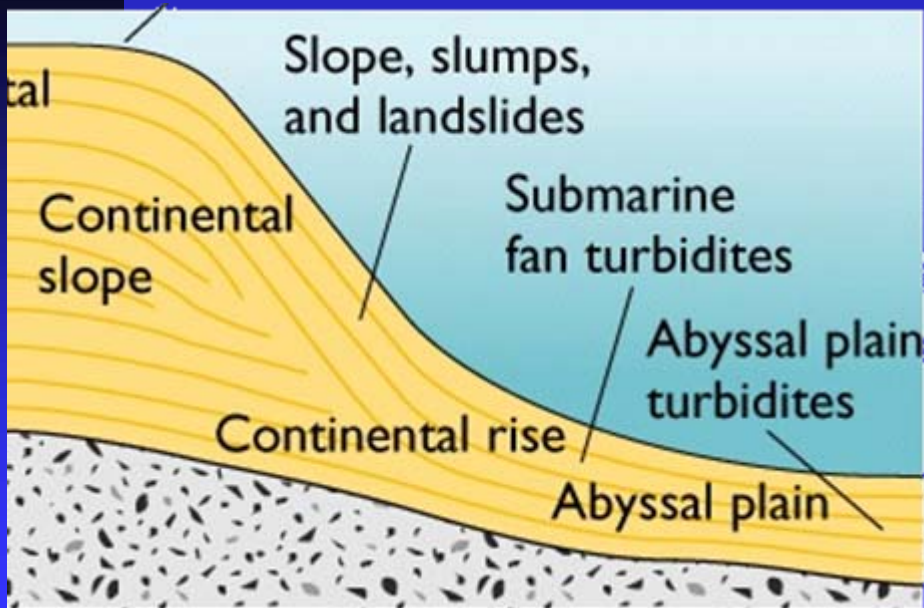
- ◆ Relatively steep slope separating the continental shelf from the continental rise.
- ◆ Averages 4 degrees but can range up to nearly vertical.
 - ◆ The continental slope off the western edge of Florida is nearly vertical and would make great rock climbing material if the Gulf of Mexico were drained.

Continental Rise

- ◆ this is a province of very gentle slope between the continental slope and the abyssal plains.
- ◆ the continental rise is made up of piles of sediment that have been delivered to the deep sea from the continental shelf.

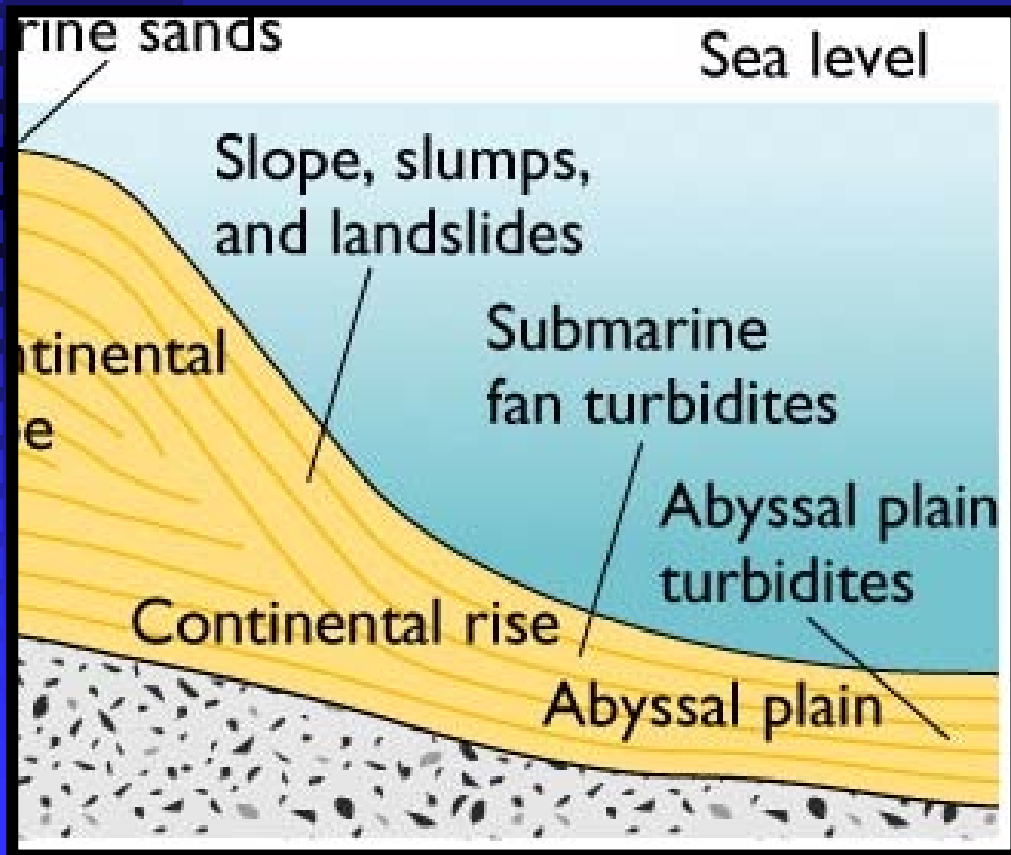
Submarine canyons

- ◆ The continental shelf and slope are cut in many places by magnificent canyons large enough to dwarf the Grand Canyon. Many of these are located off the mouths of major rivers, such as the Hudson Canyon. Their origin remains mysterious but is likely due to the sediment washed into the ocean by the rivers.



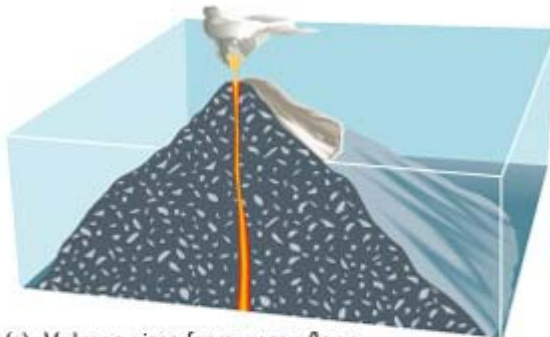
■ Abyssal Plains

- ◆ These are the flattest places on earth where the slow but steady rain of sediment has blanketed the ocean crust and smoothed out the irregularities. Water depth 4-6 km

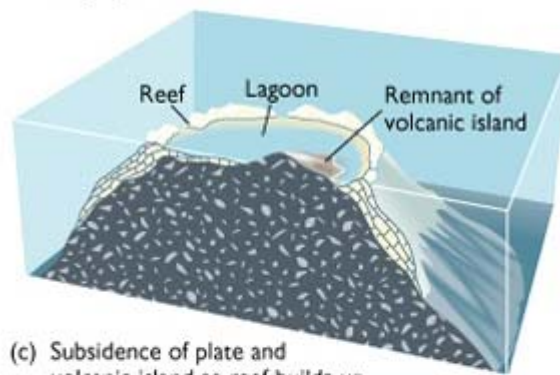


Atoll

Central circular lagoon fringed by coral islands



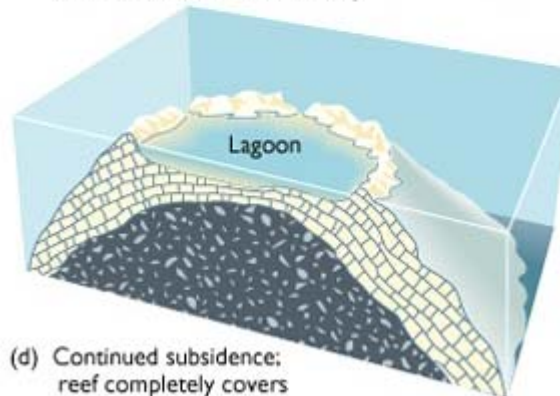
(a) Volcano rises from ocean floor



(c) Subsidence of plate and volcanic island as reef builds up



(b) Volcano extinct; fringing reef forms



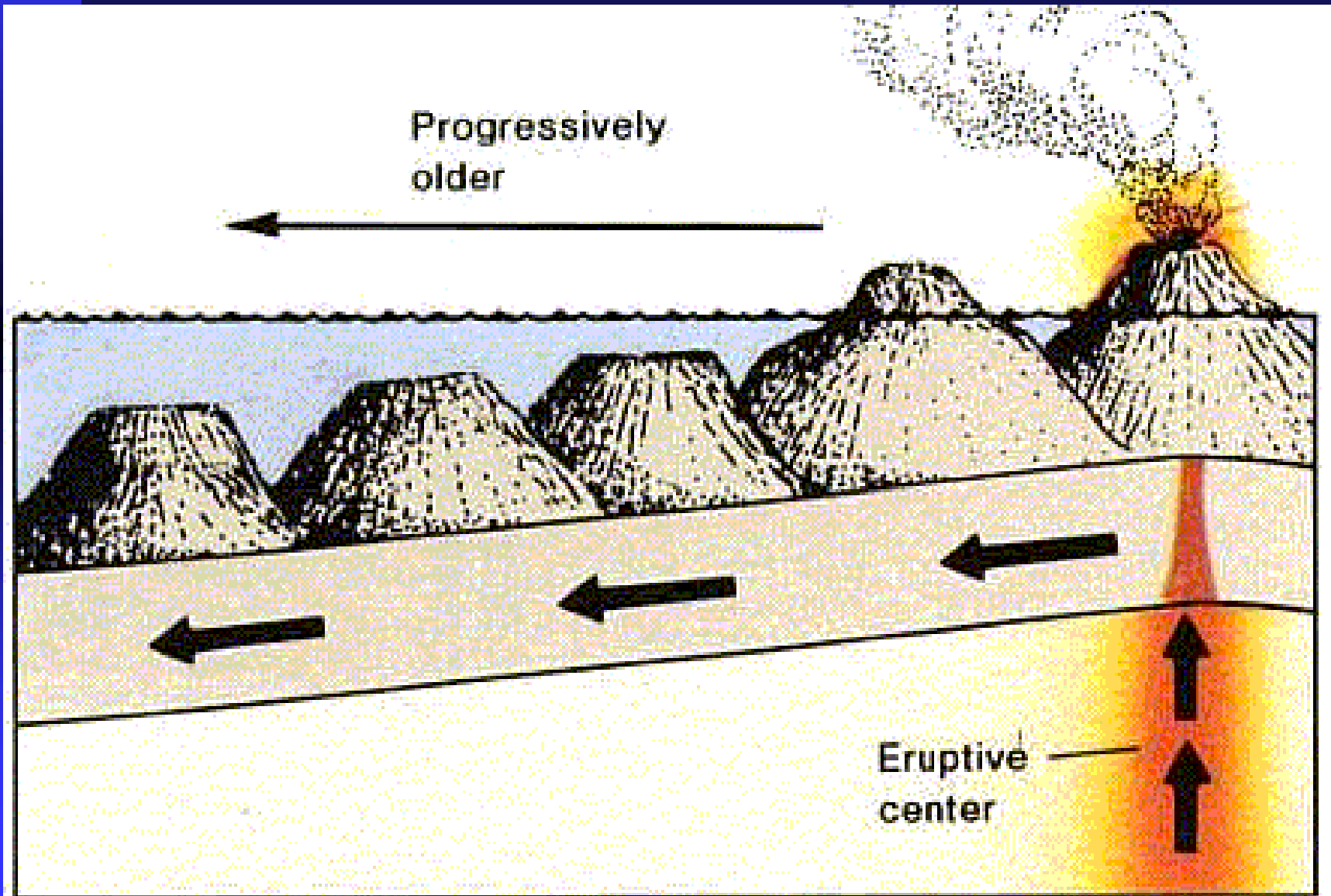
(d) Continued subsidence; reef completely covers buried volcanic island



Seamounts

- ◆ **Seamounts** are isolated submarine volcanoes. Occasionally these volcanoes reach the sea surface and form volcanic islands. The western Pacific Ocean has an unusual abundance of seamounts. These islands often rise over 9.5 km above the surrounding seafloor, dwarfing Mt. Everest in total relief.
- ◆ Flat top seamounts are also called **tablemounts** or ***guyots***
- ◆ Seamounts less than 1000 meter in height are called **abyssal hills** or **sea-knolls**

Seamount and Guyot



Mid-Oceanic Ridges

- 1. These are the most conspicuous features of the ocean basins.
- 2. The mid-ocean ridge is a continuous chain of mountains that runs from the central Arctic Ocean down through the Atlantic, through the Indian Ocean and northward through the eastern Pacific.
- 3. The mid-ocean ridge is approximately 1000 km wide and rises 1000 to 3000 m above the adjacent seafloor.
- 4. The mid-ocean ridge is 60,000 km long and covers 21% of Earth's surface.
- 5. Many portions of the ridge have valleys that run along the crest of the ridge. These are called central or axial rift valleys.



The world is a beautiful place, and it is our duty to protect it. We must take care of our planet, and we must work together to make a better world for all of us.

Distribution of the oceanic ridge system

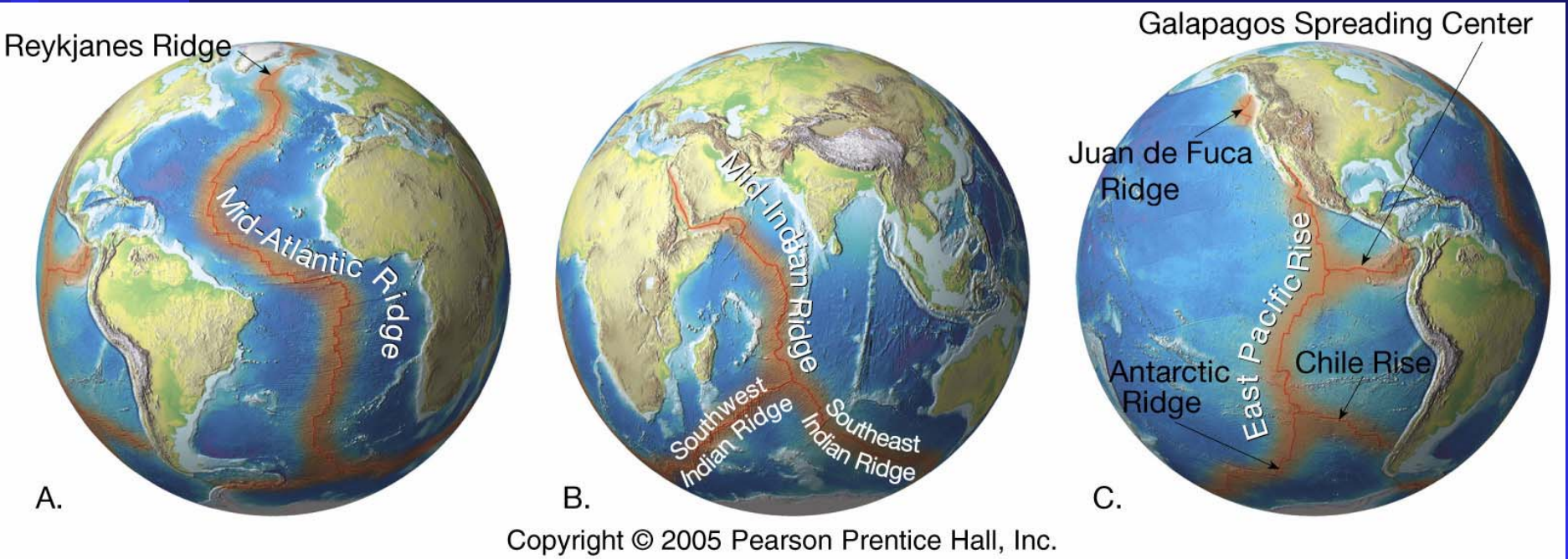
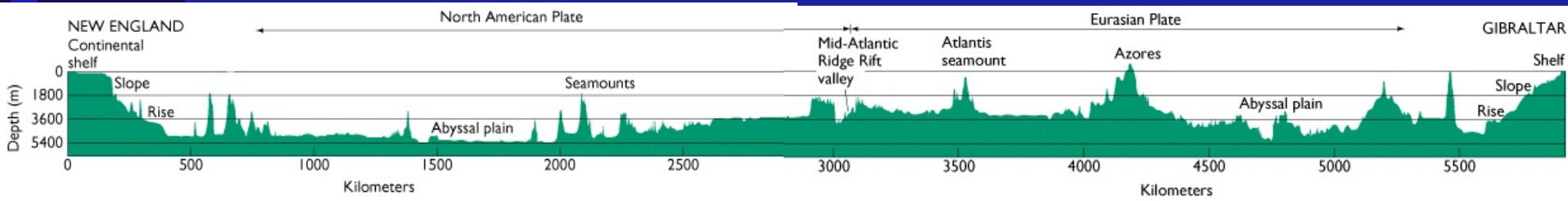


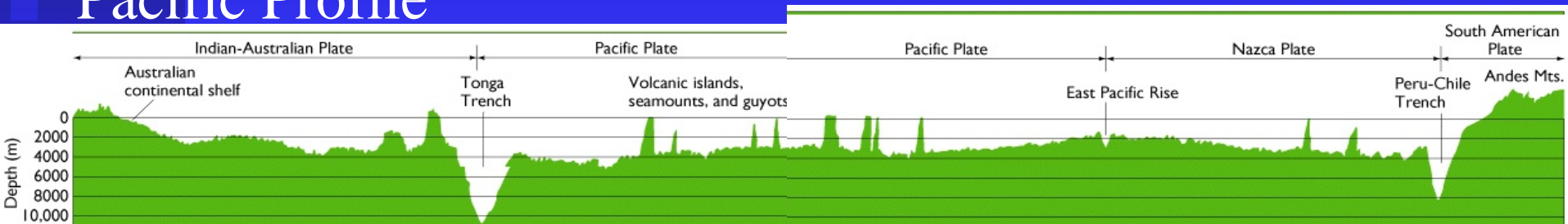
Figure 13.11

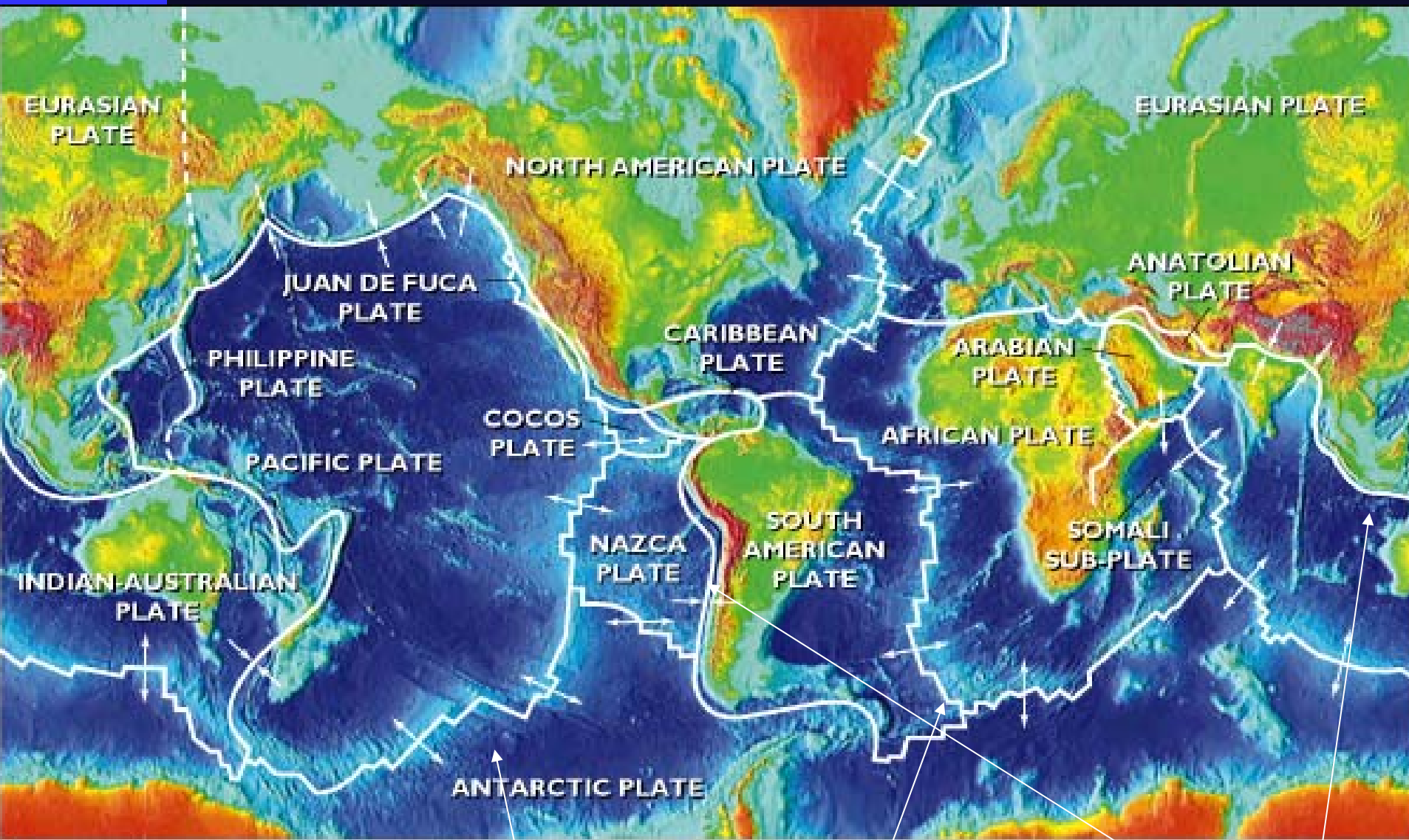
Ocean Profile

Atlantic Profile



Pacific Profile

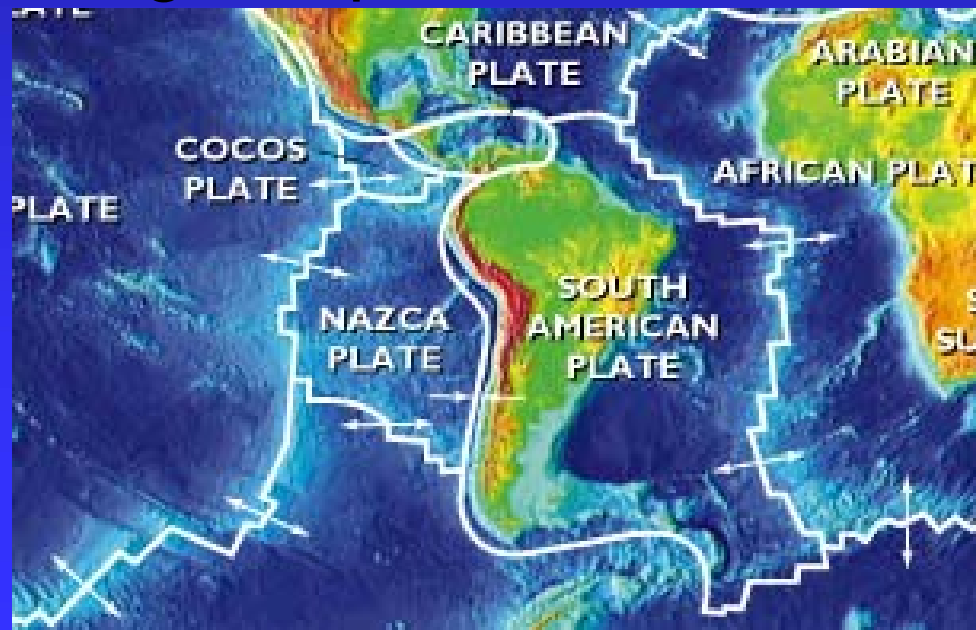




Physiographic map of the world showing plate boundaries and major Ocean-floor features like fracture zones, mid-oceanic ridges and trenches

Fracture Zones and Transform Faults

- Semi-parallel fractures that cut across and offset mid-ocean ridges.
- Numerous shallow earthquakes occur along the portion of fracture zones in between the ridge axes. These active fractures are called Transform faults
- May reach lengths up to 3500 km.



Marginal Trenches

- Narrow, steep-sided troughs parallel to continental margins.
- Remarkable for their length and continuity - the Peru-Chile Trench is 5900 km long and 100 km wide.
- Drop 2 to 4 km below the adjacent seafloor to form the deepest parts of the ocean (water depths up to 11 km)!

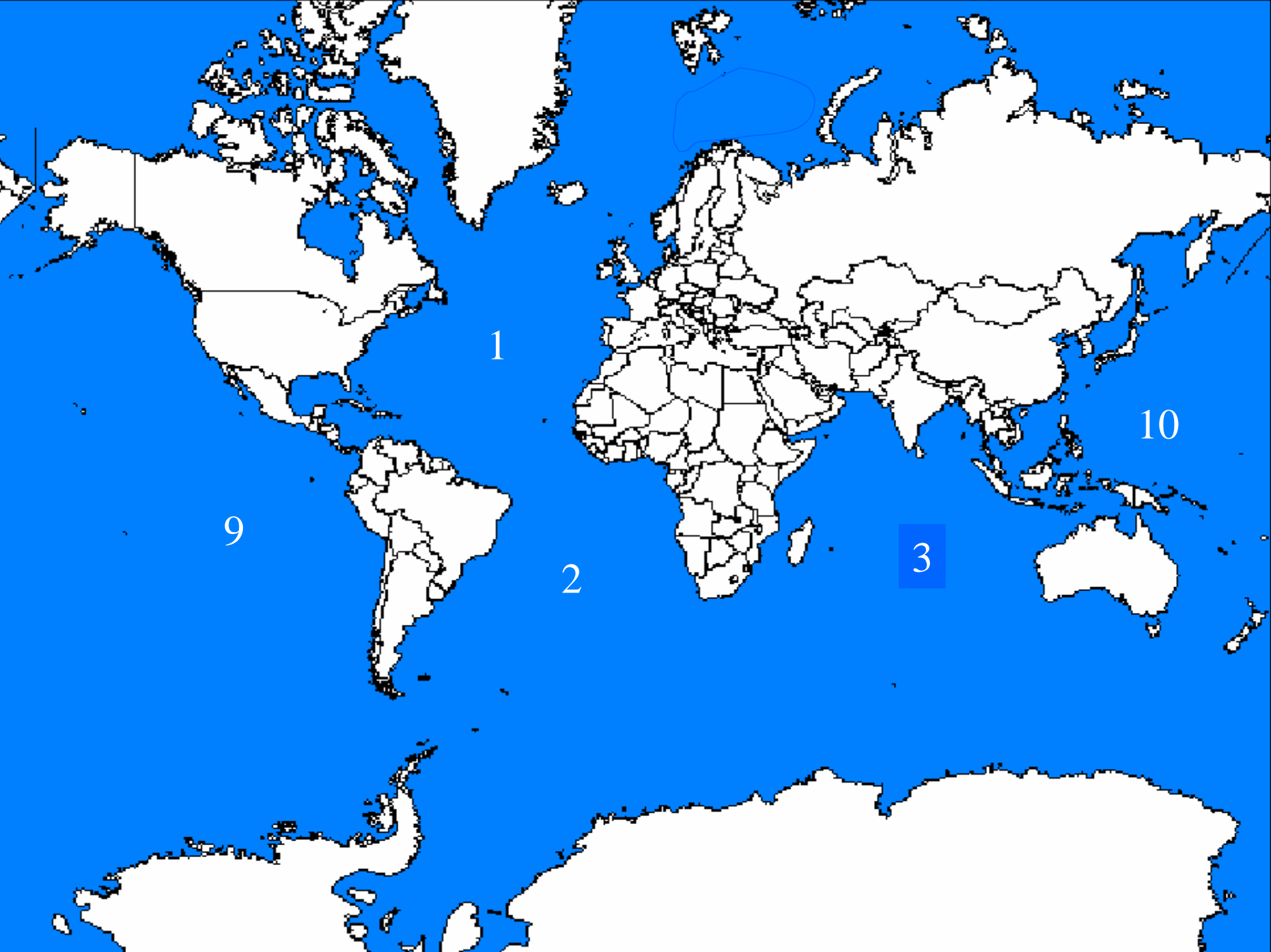




Computer generated
Image of a Trench

Locate the following on the map

- 1. North Atlantic Ocean**
- 2. South Atlantic Ocean**
- 3. Indian Ocean**
- 4. Mediterranean Sea**
- 5. Caribbean Sea**
- 6. Gulf of Mexico**
- 7. Labrador Sea**
- 8. Norwegian Sea**
- 9. East Pacific Ocean**
- 10. West Pacific Ocean**
- 11. North Sea**
- 12. Baltic Sea**
- 13. Weddell Sea**
- 14. Straits of Gibraltar**
- 15. Drake Passage**



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