

Lecture Outlines PowerPoint

Chapter 13 *Earth Science, 12e* Tarbuck/Lutgens

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Earth Science, ***12e***

The Ocean Floor ***Chapter 13***

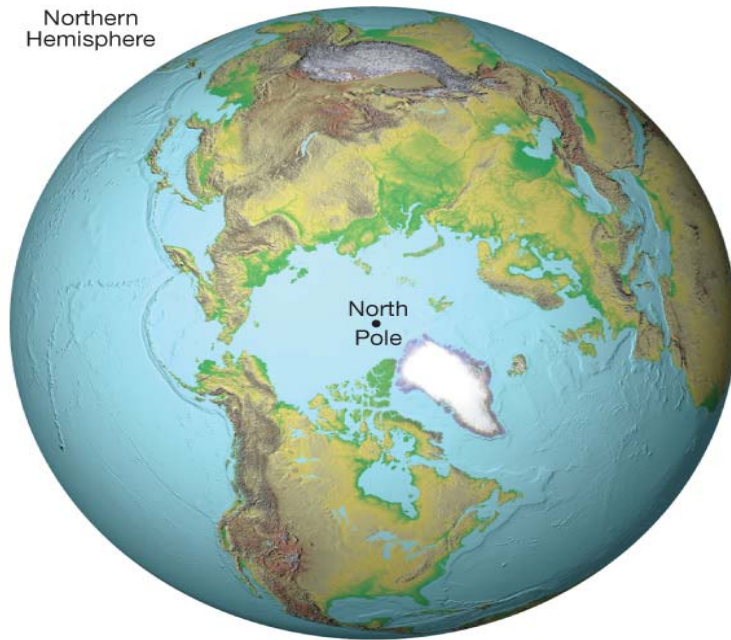


The vast world ocean

- ❖ Earth is often referred to as the blue planet
 - Seventy-one percent of Earth's surface is represented by oceans and marginal seas
 - Continents and islands comprise the remaining 29 percent
- ❖ Northern Hemisphere is called the land hemisphere, and the Southern Hemisphere the water hemisphere



Northern Hemisphere



North Pole



South Pole

Southern Hemisphere

Views of the Northern and Southern Hemispheres

Figure 13.1

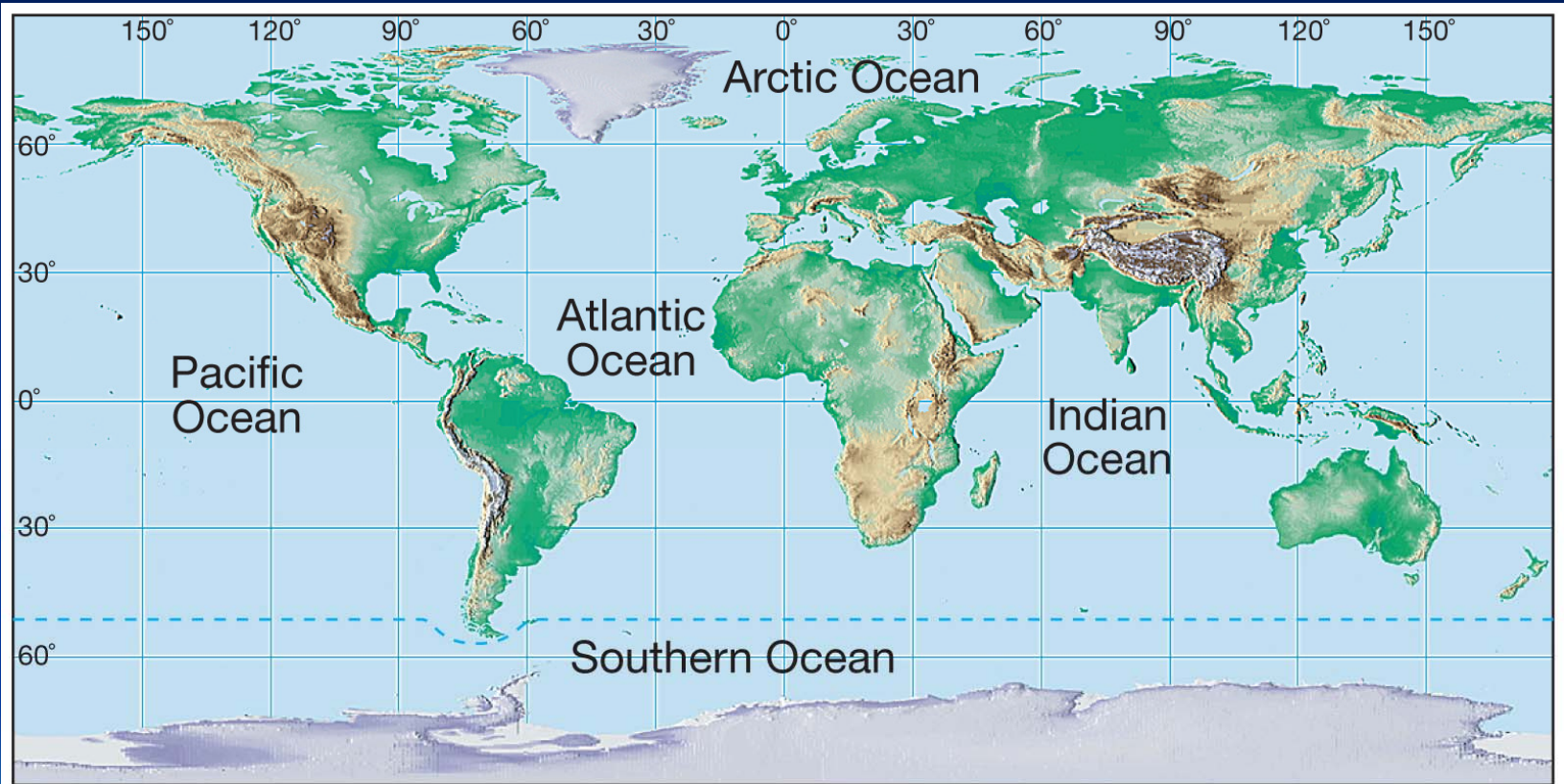
The vast world ocean

❖ Four main ocean basins

- **Pacific Ocean** – the largest and has the greatest depth
- **Atlantic Ocean** – about half the size of the Pacific and not quite as deep
- **Indian Ocean** – slightly smaller than the Atlantic, largely a Southern Hemisphere body
- **Arctic Ocean** – about 7 percent the size of the Pacific



The oceans of Earth



B.

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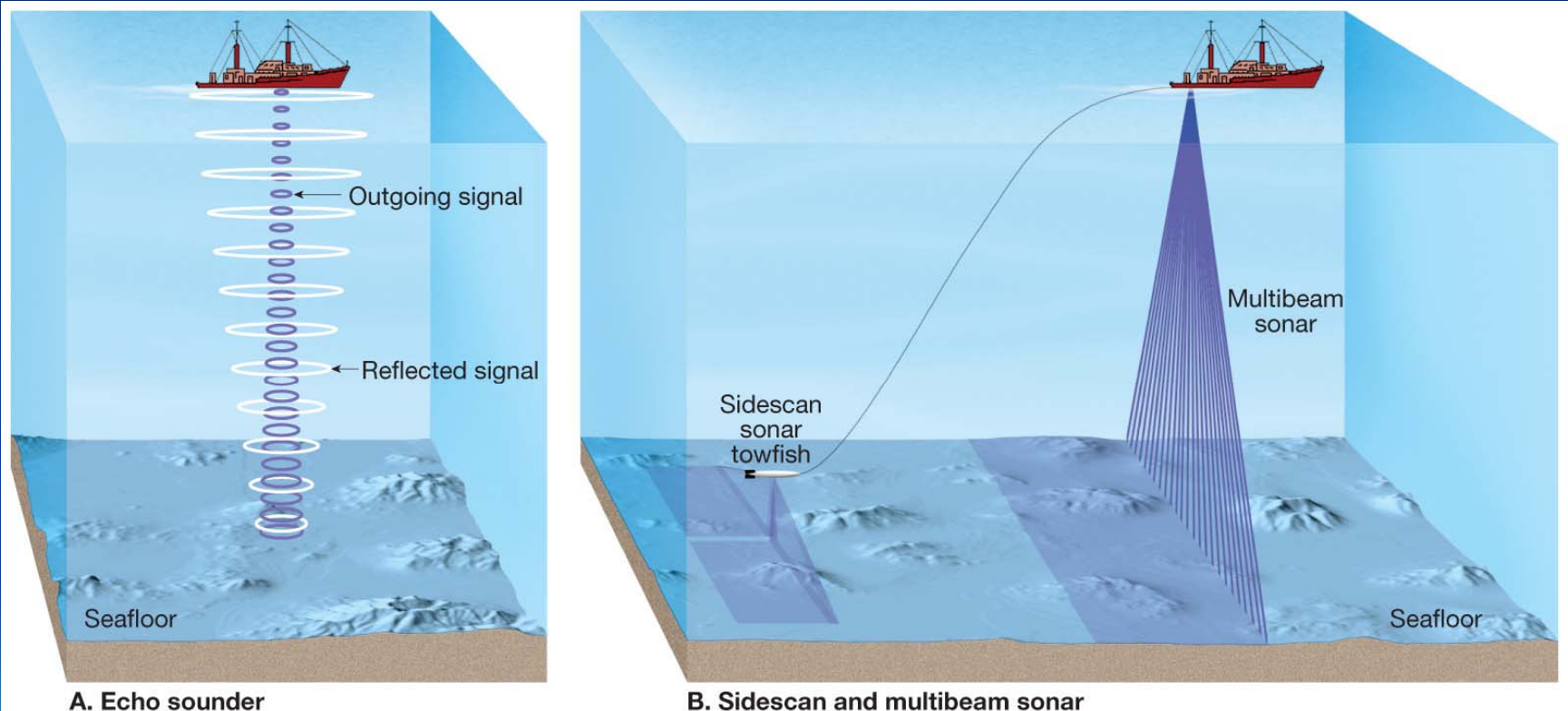
Figure 13.2 B

Mapping the ocean floor

- ❖ **Bathymetry** – measurement of ocean depths and the charting of the shape or topography of the ocean floor
- ❖ **Echo sounder** (also referred to as **sonar**)
 - Invented in the 1920s
 - Primary instrument for measuring depth
 - Reflects sound from ocean floor



Echo sounder and multibeam sonar



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Figure 13.4

Mapping the ocean floor

❖ **Multibeam sonar**

- Employs an array of sound sources and listening devices
- Obtains a profile of a narrow strip of seafloor

❖ Measuring the shape of the ocean surface from space



Mapping the ocean floor

❖ Three major topographic units of the ocean floor

- Continental margins
- Ocean basin floor
- Mid-ocean ridge



Major topographic divisions of the North Atlantic Ocean

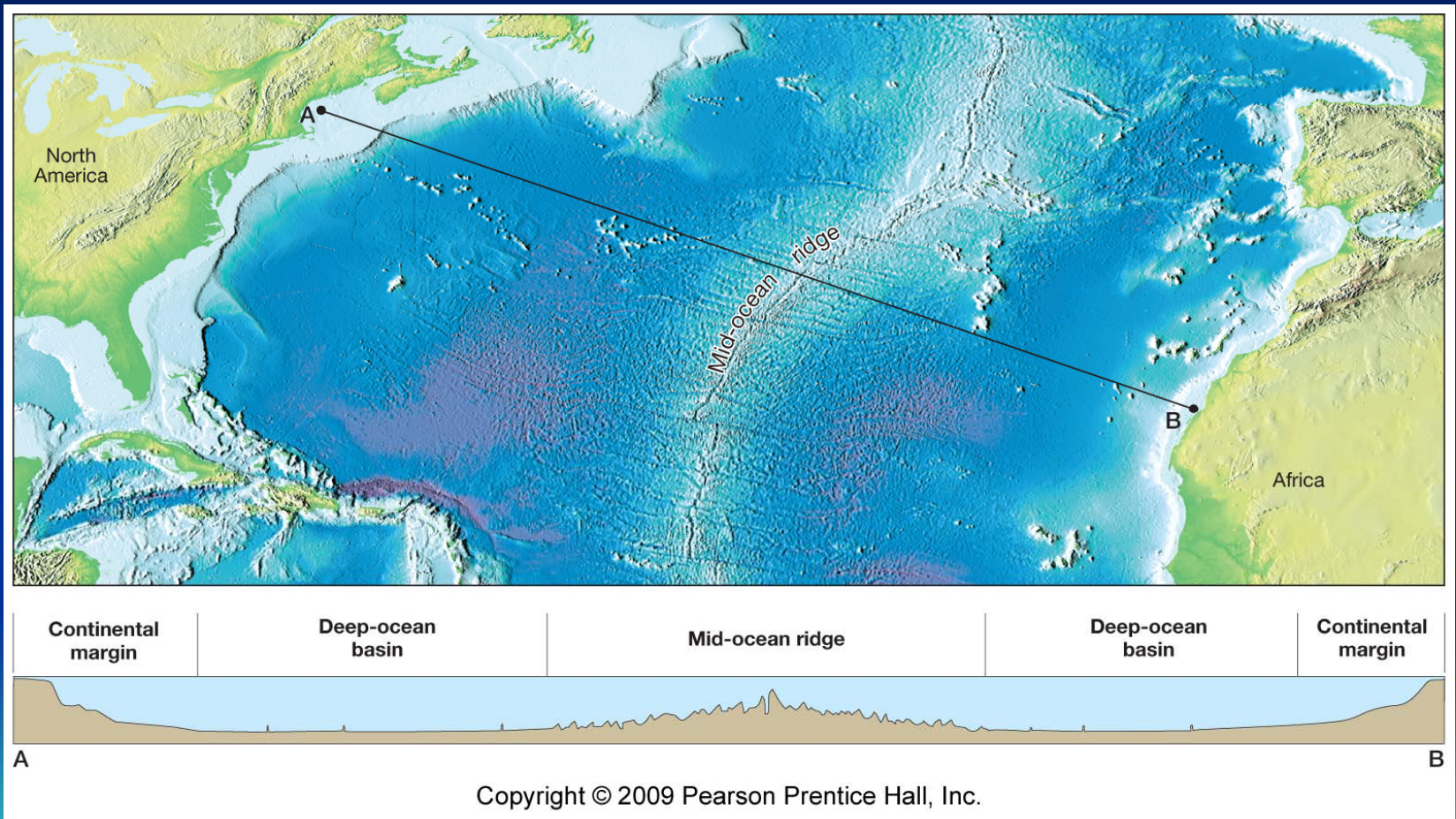


Figure 13.8

Continental margins

❖ **Passive continental margins**

- Found along most coastal areas that surround the Atlantic Ocean
- Not associated with plate boundaries
 - Experience little volcanism and
 - Few earthquakes



Continental margins

❖ Passive continental margins

- Features comprising a passive continental margin
 - **Continental shelf**
 - Flooded extension of the continent
 - Varies greatly in width
 - Gently sloping
 - Contains oil and important mineral deposits



Continental margins

❖ Passive continental margins

- Features comprising a passive continental margin
 - Continental shelf
 - Some areas are mantled by extensive glacial deposits
 - Most consist of thick accumulations of shallow-water sediments



Continental margins

❖ Passive continental margins

- Features comprising a passive continental margin
 - **Continental slope**
 - Marks the seaward edge of the continental shelf
 - Relatively steep structure
 - Boundary between continental crust and oceanic crust



Continental margins

❖ Passive continental margins

- Features comprising a passive continental margin
 - Submarine canyons and turbidity currents
 - **Submarine canyons**
 - Deep, steep-sided valleys cut into the continental slope
 - Some are seaward extensions of river valleys
 - Most appear to have been eroded by turbidity currents



Continental margins

❖ Passive continental margins

- Features comprising a passive continental margin
 - Submarine canyons and turbidity currents
 - **Turbidity currents**
 - Downslope movements of dense, sediment-laden water
 - Deposits are called **turbidites**



Turbidity currents

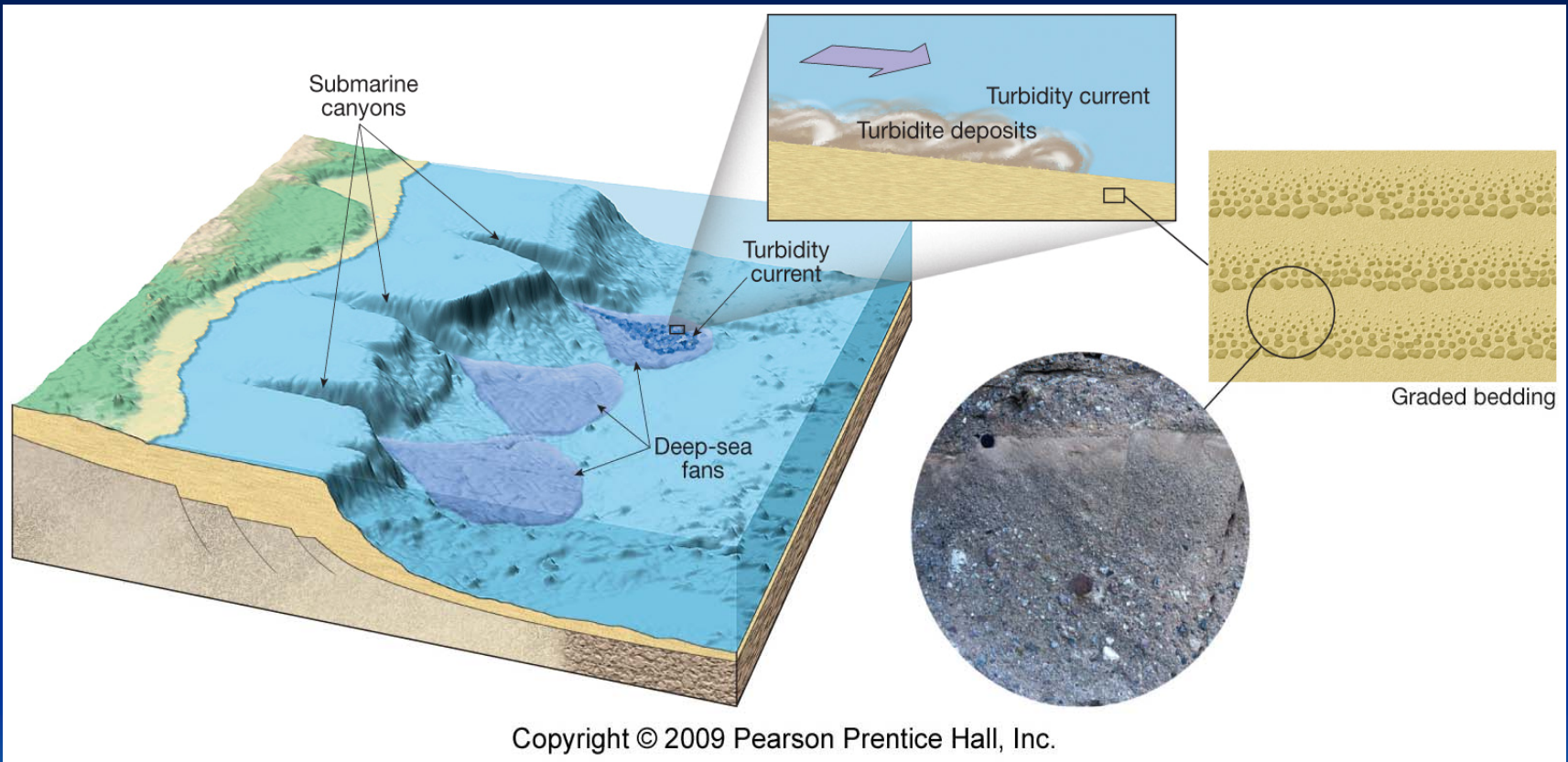


Figure 13.10

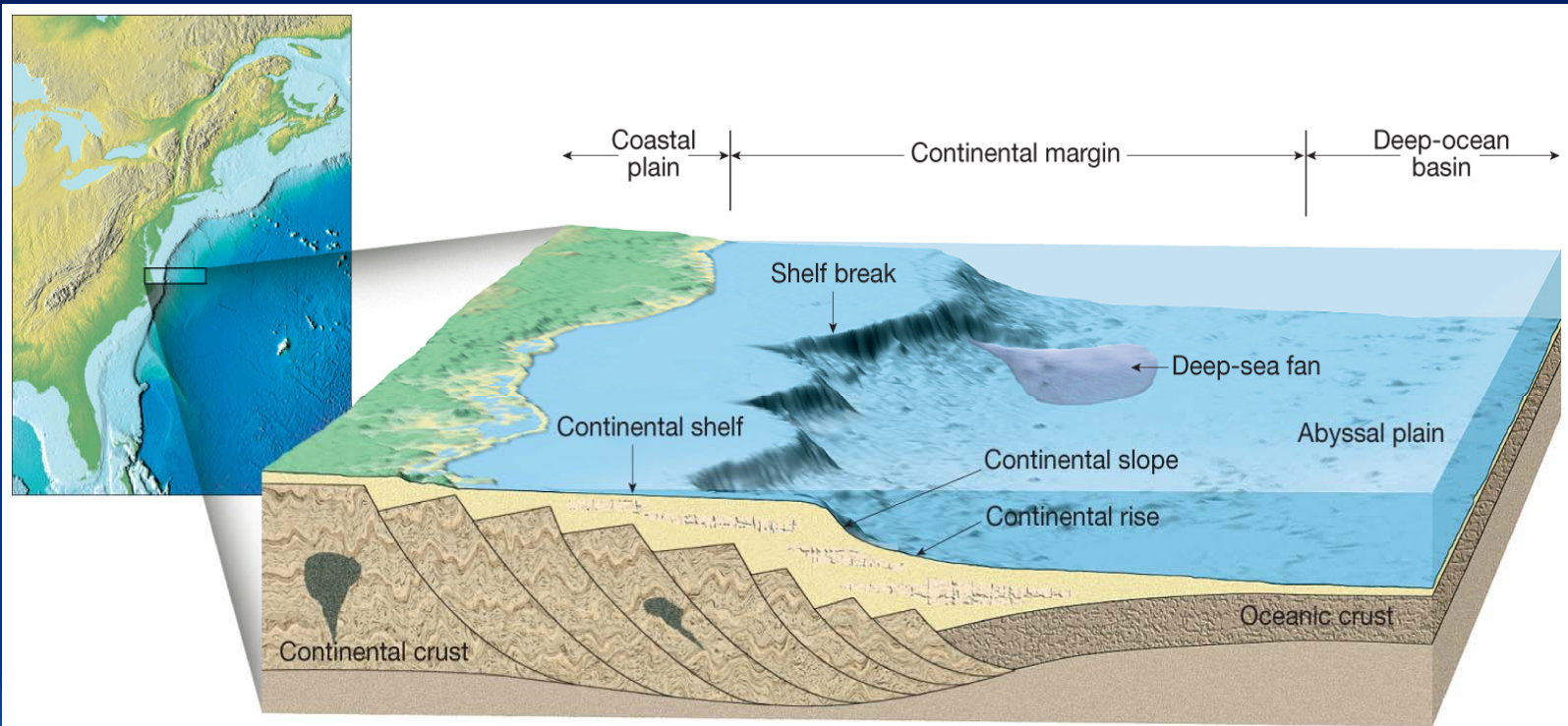
Continental margins

❖ Passive continental margins

- Features comprising a passive continental margin
 - **Continental rise**
 - Found in regions where trenches are absent
 - Continental slope merges into a more gradual incline – the continental rise
 - Thick accumulation of sediment
 - At the base of the continental slope turbidity currents that follow submarine canyons deposit sediment that forms deep-sea fans



Features of a passive continental margin



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Figure 13.9

Continental margins

❖ **Active continental margins**

- Continental slope descends abruptly into a deep-ocean trench
- Located primarily around the Pacific Ocean
- Accumulations of deformed sediment and scraps of ocean crust form **accretionary wedges**
- Some subduction zones have little or no accumulation of sediments



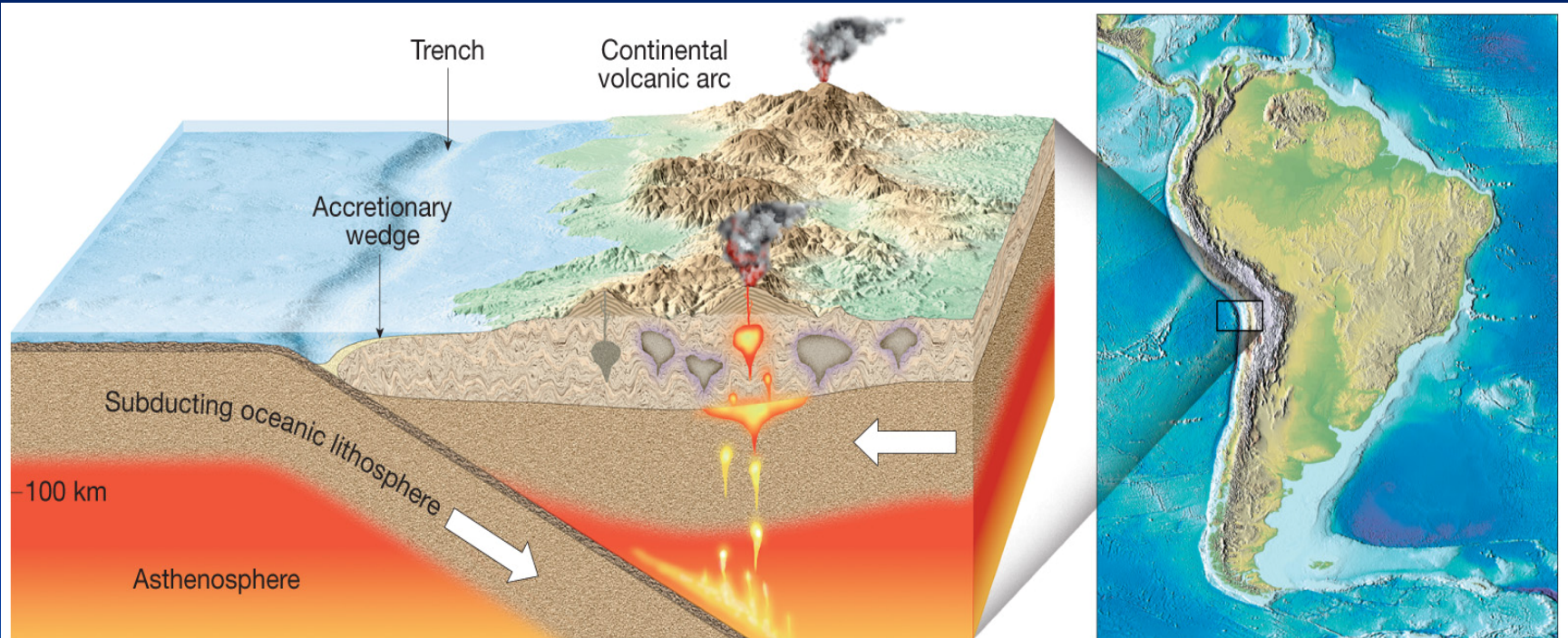
Ocean basin floor

❖ **Deep-ocean trenches**

- Long, relatively narrow features
- Deepest parts of ocean
- Most are located in the Pacific Ocean
- Sites where moving lithospheric plates plunge into the mantle
- Associated with volcanic activity
 - **Volcanic island arcs**
 - **Continental volcanic arcs**



An active continental margin



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Figure 13.11

Ocean basin floor

❖ **Abyssal plains**

- Likely the most level places on Earth
- Sites of thick accumulations of sediment
- Found in all oceans

❖ **Seamounts and guyots**

- Isolated volcanic peaks
- Many form near oceanic ridges



Ocean basin floor

❖ Seamounts and guyots

- May emerge as an island
- May sink and form flat-topped seamounts called **guyots** or **tablemounts**

❖ **Mid-ocean ridge**

- Characterized by
 - An elevated position
 - Extensive faulting
 - Numerous volcanic structures that have developed on newly formed crust



Ocean basin floor

❖ Mid-ocean ridge

- Interconnected ridge system is the longest topographic feature on Earth's surface
 - Over 70,000 kilometers (43,000 miles) in length
 - Twenty-three percent of Earth's surface
 - Winds through all major oceans
- Along the axis of some segments are deep downfaulted structures called **rift valleys**



Ocean basin floor

❖ Mid-ocean ridge

- Consists of layer upon layer of basaltic rocks that have been faulted and uplifted
- Mid-Atlantic Ridge has been studied more thoroughly than any other ridge system



Seafloor sediments

- ❖ Ocean floor is mantled with sediment
- ❖ Sources
 - Turbidity currents
 - Sediment that slowly settles to the bottom from above
- ❖ Thickness varies
 - Thickest in trenches – accumulations may approach 10 kilometers



Seafloor sediments

❖ Thickness varies

- Pacific Ocean – about 600 meters or less
- Atlantic Ocean – from 500 to 1,000 meters thick

❖ Mud is the most common sediment on the deep-ocean floor



Seafloor sediments

❖ Types of seafloor sediments

- **Terrigenous sediment**
 - Material weathered from continental rocks
 - Virtually every part of the ocean receives some
 - Fine particles remain suspended for a long time
 - Oxidation often produces red- and brown-colored sediments



Seafloor sediments

❖ Types of seafloor sediments

- **Biogenous sediment**
 - Shells and skeletons of marine animals and plants
 - Most common are **calcareous oozes** produced from microscopic organisms that inhabit warm surface waters
 - **Siliceous oozes** composed of skeletons of diatoms and radiolarians
 - Phosphate-rich materials derived from the bones, teeth, and scales of fish and other marine organisms



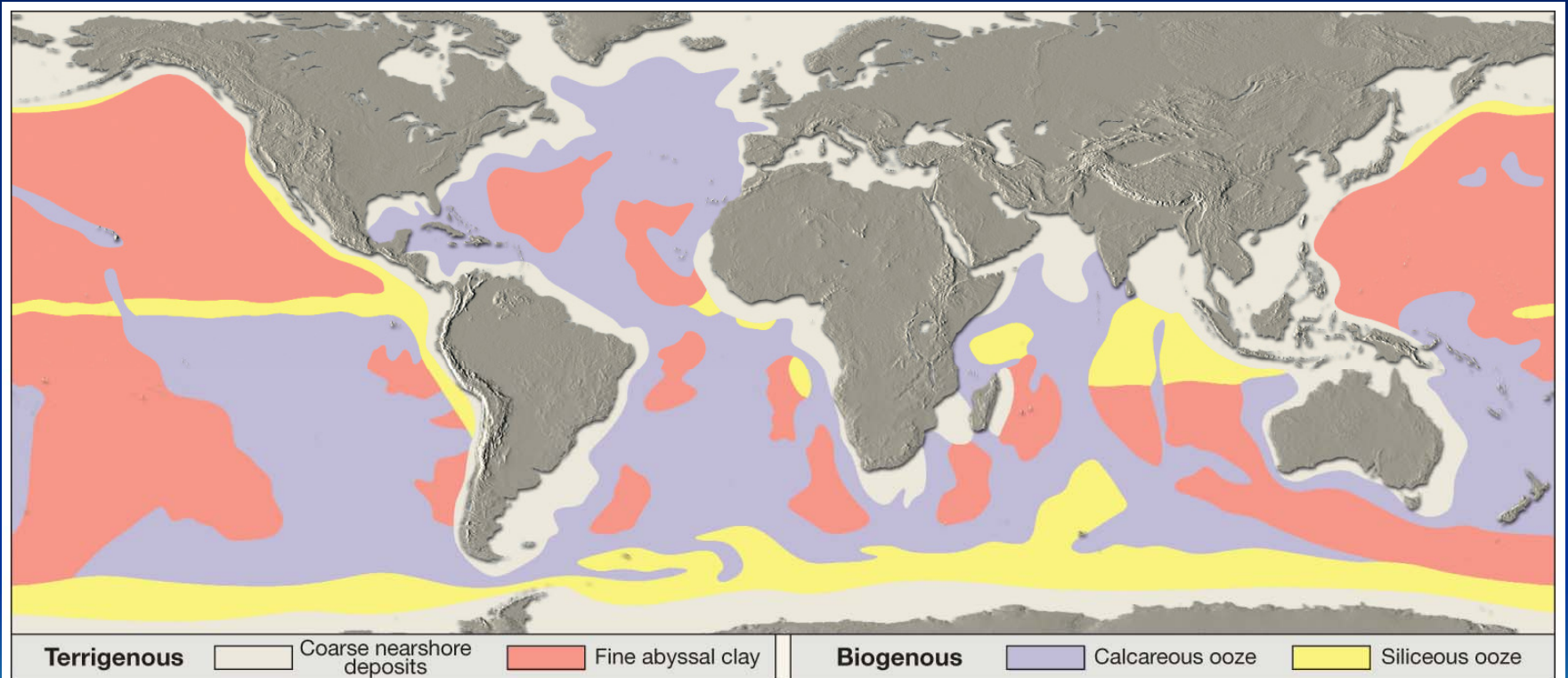
Seafloor sediments

❖ Types of seafloor sediments

- **Hydrogenous sediment**
 - Minerals that crystallize directly from seawater
 - Most common types include
 - Manganese nodules
 - Calcium carbonates
 - Metal sulfides
 - Evaporites



Distribution of marine sediments



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Figure 13.18

Seafloor sediments

❖ Distribution

- Coarse terrigenous deposits dominate continental margin areas
- Fine-grained terrigenous material is common in deeper areas of the ocean basin
- Hydrogenous sediment comprises only a small portion of deposits in the ocean
- There are a few places where very little sediment accumulates (mid-ocean ridges)



Resources from the seafloor

❖ Energy resources

- Oil and gas
- Gas hydrates

❖ Other resources

- Sand and gravel
- Evaporative salts
- Manganese nodules



End of Chapter 13

