



Oceanography, An Invitation to Marine Science | 9e
Tom Garrison

5

Sediments

Key Concepts

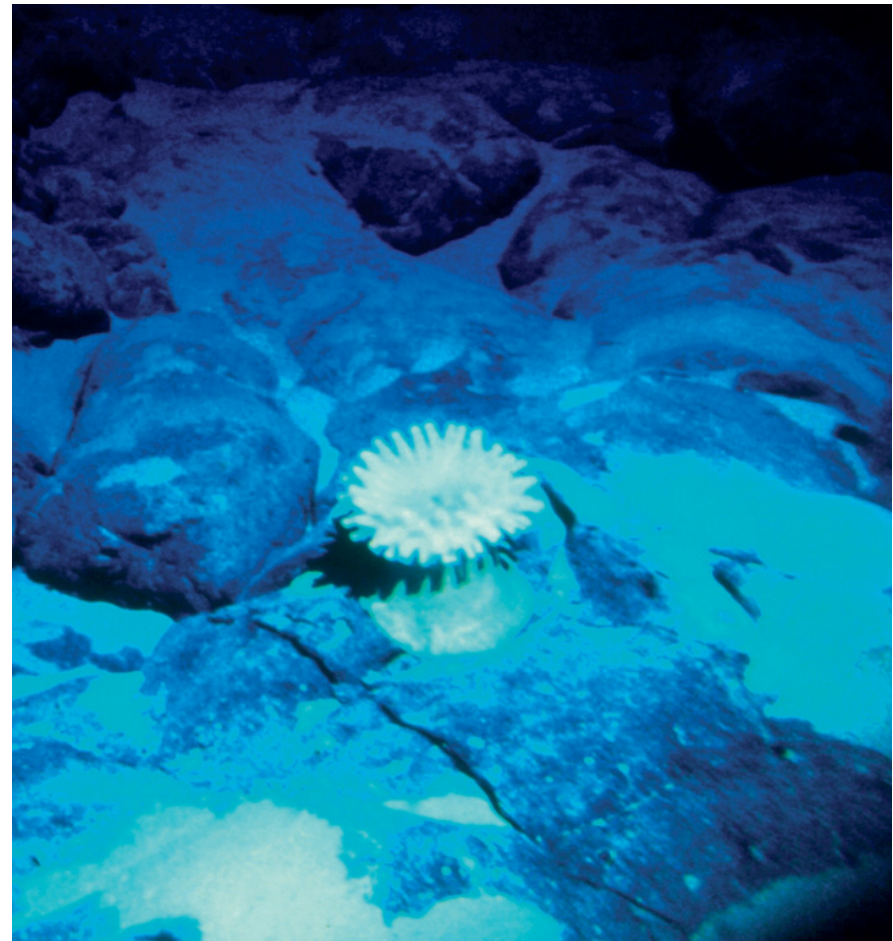
- Sediments are loose accumulations of particulate material
- The depth and composition of marine sediments tell us of relatively recent events in the ocean basin
- The most abundant sediments are terrigenous (from land) and biogenous (from once-living things)

Key Concepts

- Marine sediments have been uplifted and exposed on land (e.g., The Grand Canyon)
- Because marine sediments are usually subducted along with the seabed on which they lie, the oldest sediments are relatively young—rarely older than 180 million years

Ocean Sediments Vary Greatly in Appearance

- Particles of organic or inorganic matter that accumulate in a loose, unconsolidated form that vary according to:
 - Size
 - Source
 - Location
 - Color

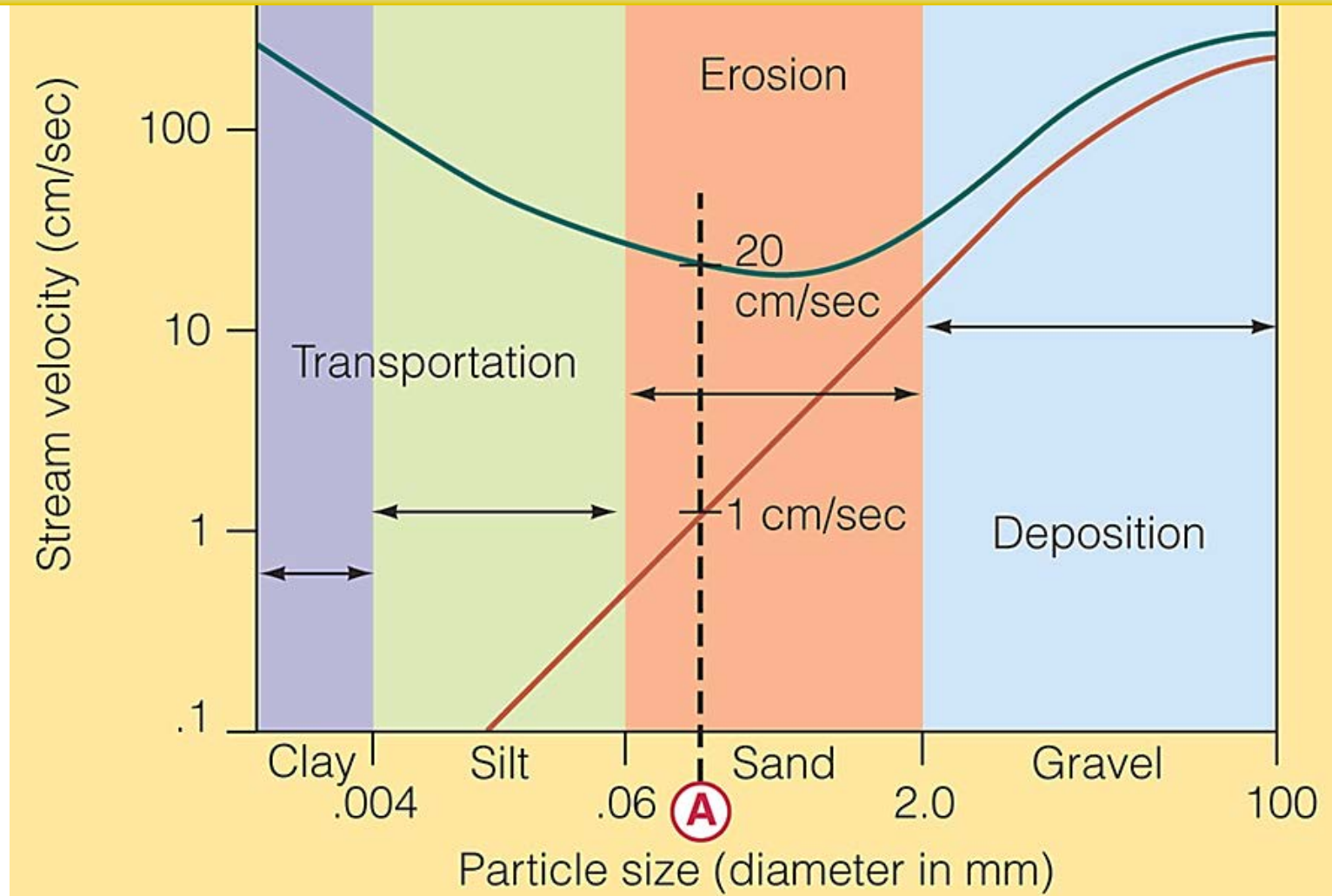


Sediments Are Classified By Particle Size

	Size Class	Size
Gravel	Boulder	>256 mm
	Cobble	64–256 mm
	Pebble	4–64 mm
	Granule	2–4 mm
Sand	Very coarse sand	1–2 mm
	Coarse sand	0.5–1 mm
	Medium sand	0.25–0.5 mm
	Fine sand	0.125–0.25 mm
	Very fine sand	0.0625–0.125 mm
Mud	Coarse silt	0.0310–0.0625 mm
	Medium to very fine silt	0.0039–0.0310 mm
	Clay	<0.0039 mm

Waves and currents
generally transport
smaller particles
farther than
larger particles

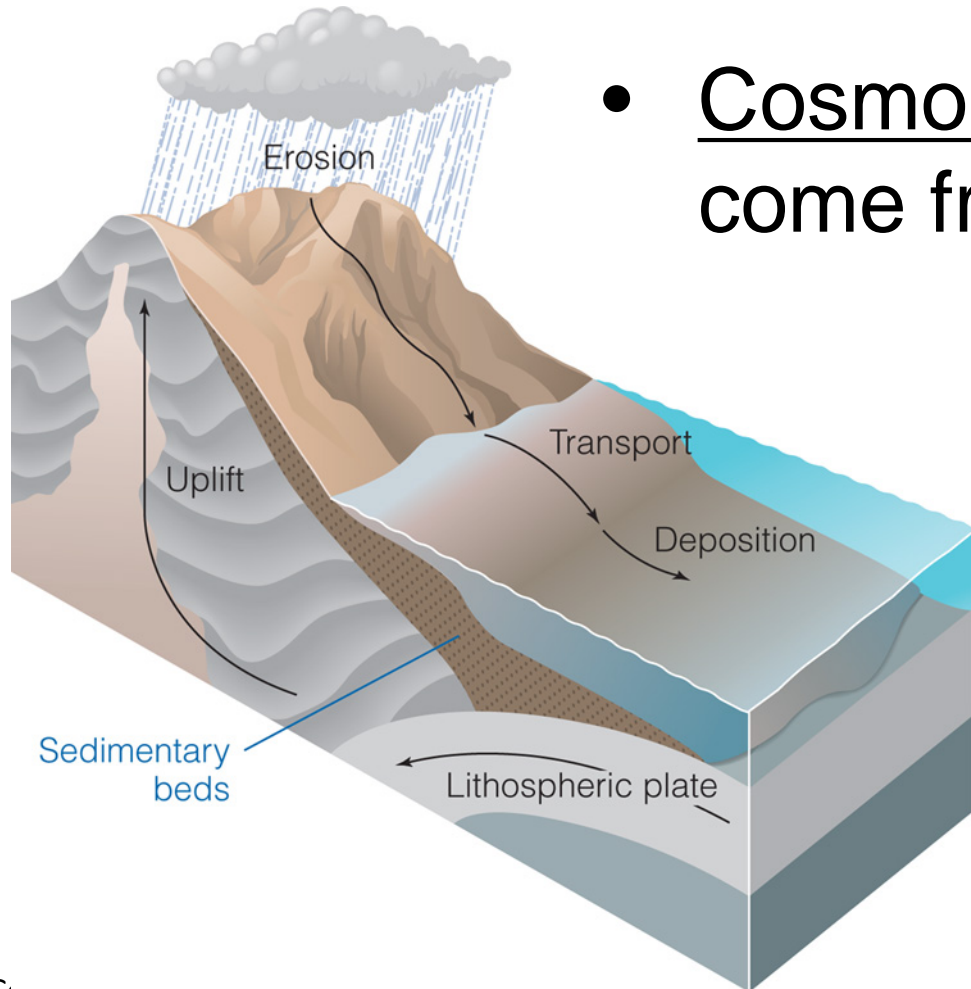
Sediments Are Classified By Particle Size



To dislodge and carry a particle (**A**), the speed of a current must exceed 20 cm/sec (8 in/sec). When current falls below 1 cm/sec (1/2 in/sec), the particle will be deposited.

Sediments May Be Classified By Source

- Terrigenous sediments come from land
 - Erosion and deposition

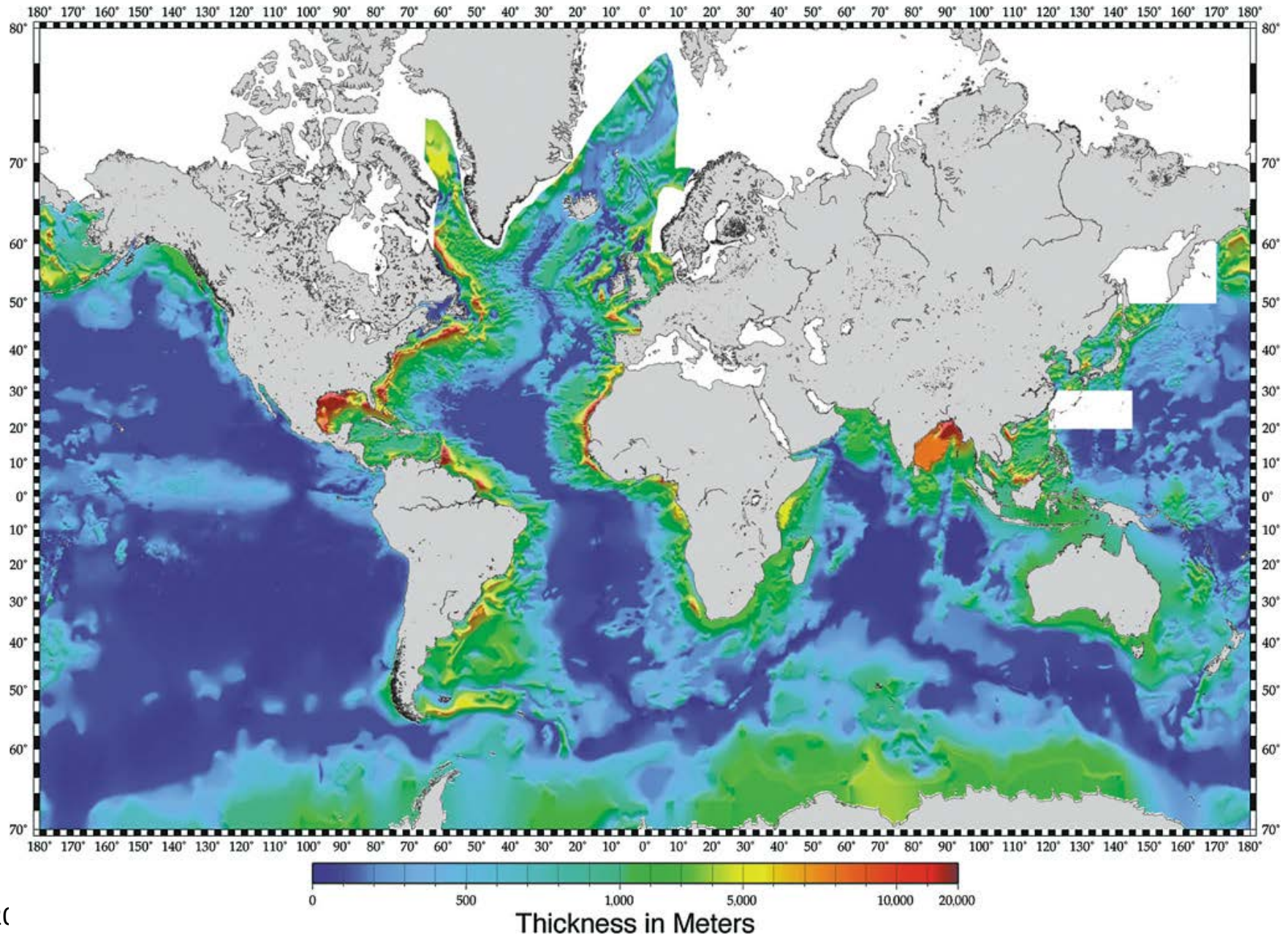


- Cosmogenous sediments come from space

Sediments May Be Classified By Source

- Biogenous sediments form from the remains of marine organisms
- Hydrogenous sediments precipitate directly from seawater
- Marine sediments are usually a combination
 - Terrigenous and biogenous most **common**

Total sediment thickness of the ocean floor



Neritic Sediments

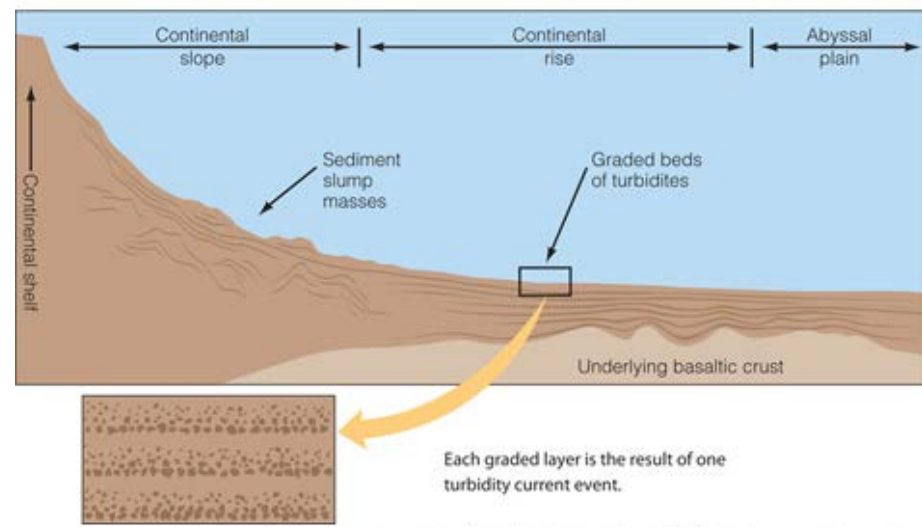
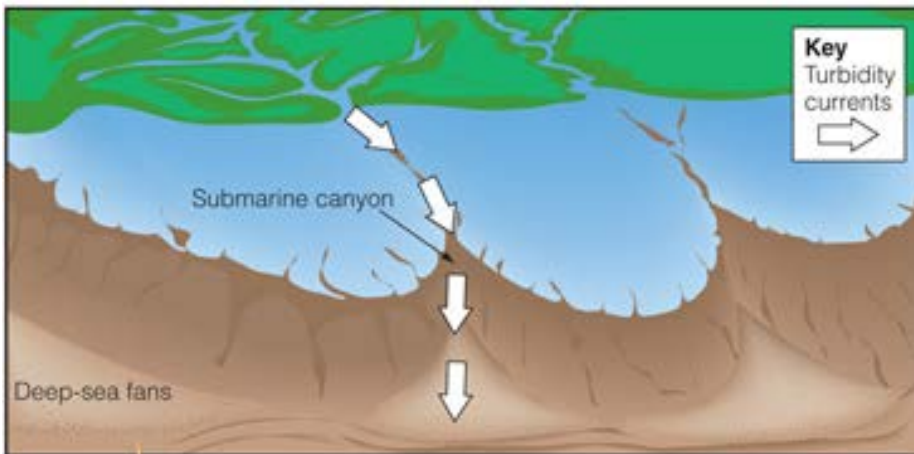
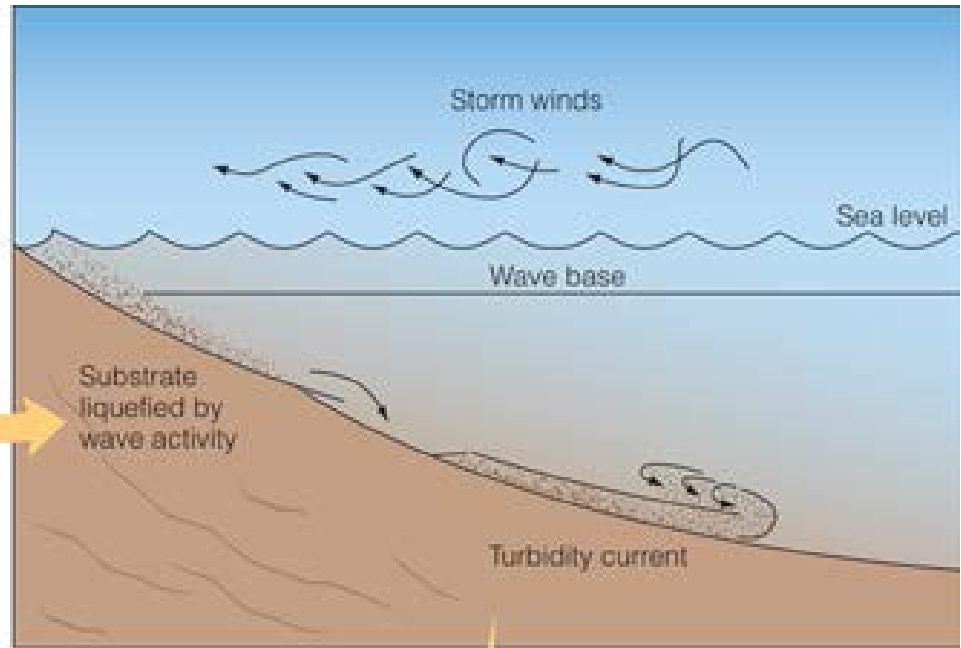
- Neritic sediments overlie continental margins
- Neritic – on the continental shelf
- Most neritic sediments are terrigenous-from land
 - Currents distribute sediments along the coast, wave action, glacial deposits
- Lithification
 - Sediments converted to sedimentary rock
 - Pressure-induced compaction
 - Cementation

Pelagic Sediments

Vary in composition and thickness

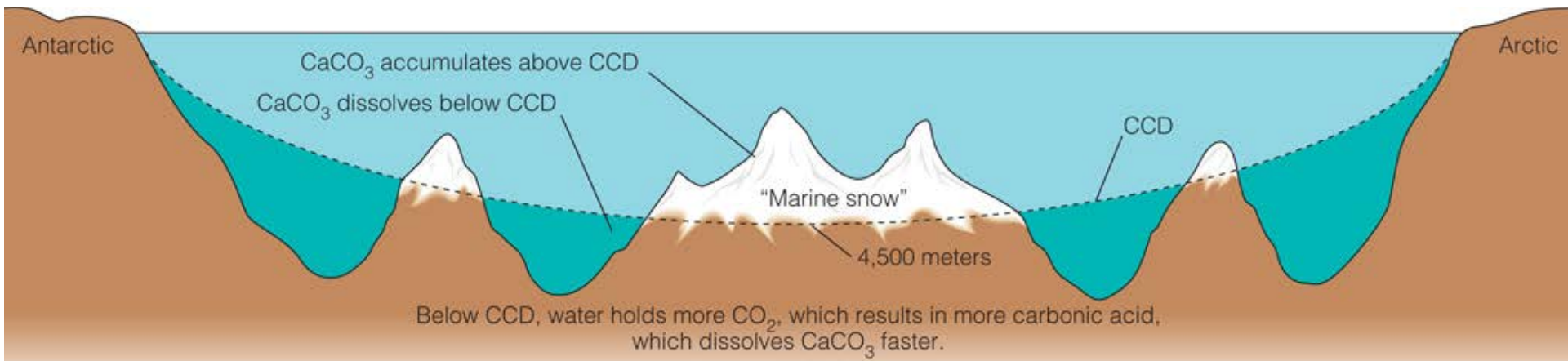
- Turbidites – deposited by turbidity currents
- Clays – most easily transported land sediment
- Oozes – remains of **living** creatures
 - Calcareous
 - Cannot exist below the CCD (calcium Carbonate Compensation depth), dissolve
 - Siliceous
 - Radiolarians, diatoms

Turbidity currents and formation of Turbidites



a) Society for Sedimentary Geology/Dr. Lynton Land; b-d) © Cengage Learning

Calcium carbonate (CaCO_3) Compensation Depth (CCD)

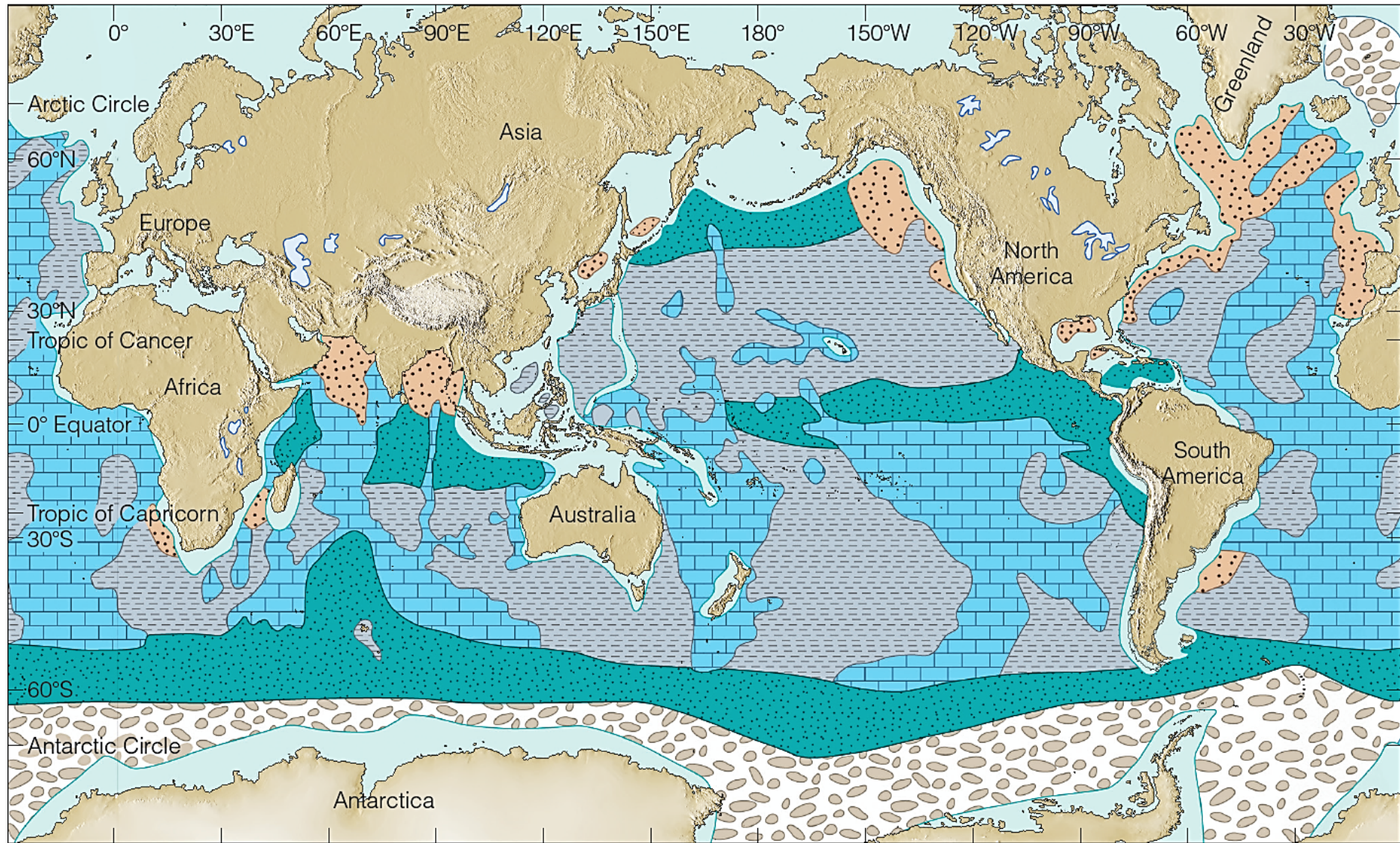


At this depth, usually about 4,500 meters (14,800 feet), the rate at which calcareous sediments accumulate equals the rate at which those sediments dissolve.

Pelagic Sediments Vary in Composition and Thickness

- **Hydrogenous (Authigenic) sediments**
precipitate out of seawater
 - Manganese nodules
- **Evaporites**
 - Include many salts
- **Oolite sands**
 - Form when calcium carbonate precipitates from seawater

The Distribution of Deep-Ocean Sediments



Calcareous ooze

Pelagic clay

Glacial-marine sediments

Siliceous ooze

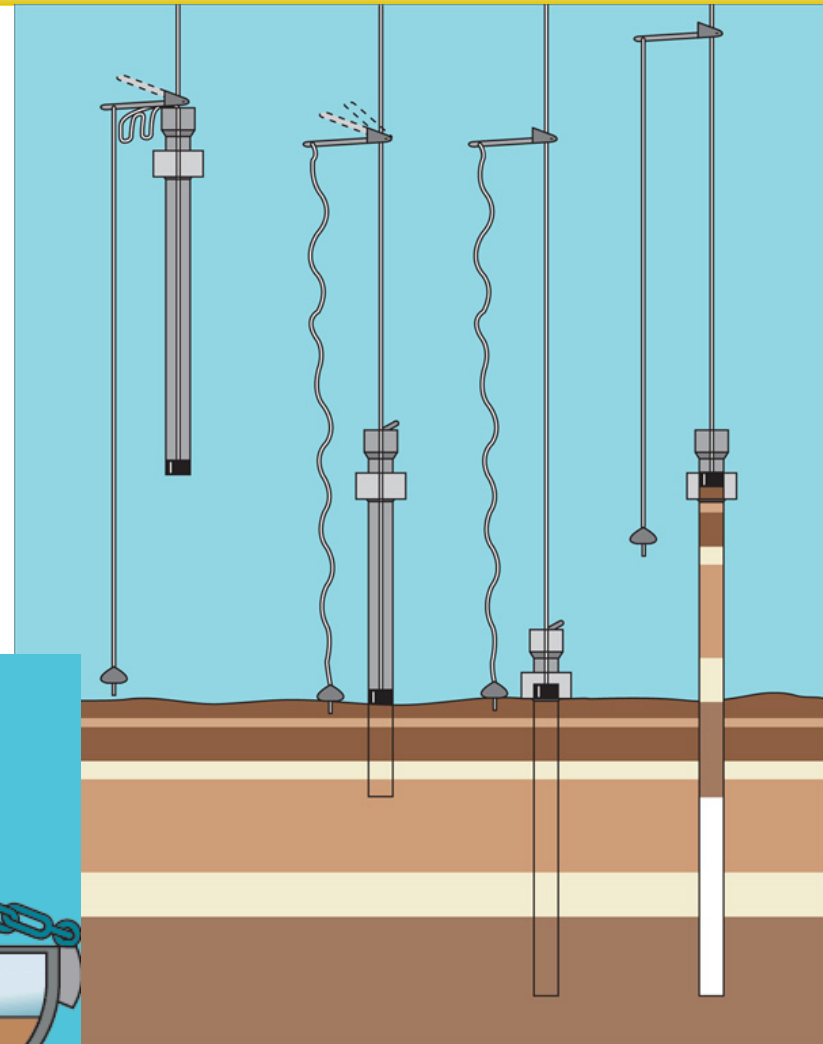
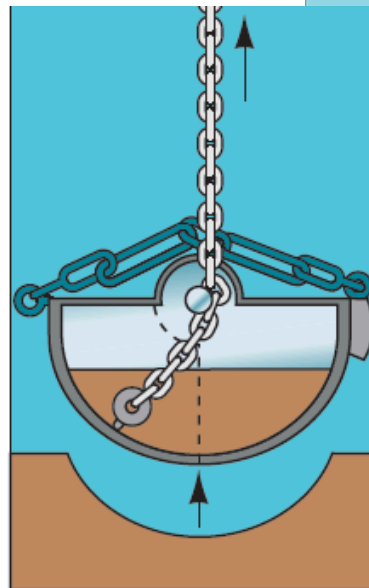
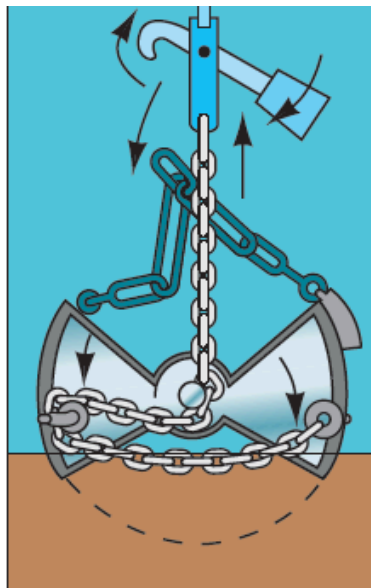
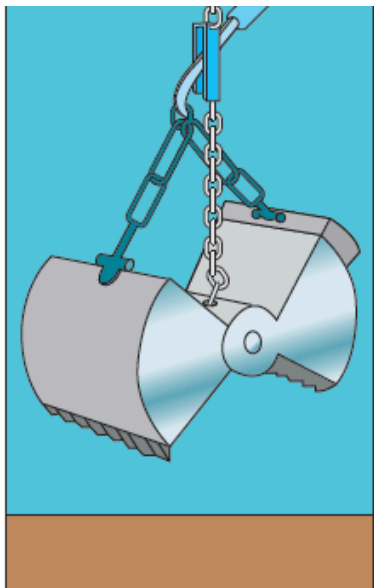
Land-derived sediments

Continental-shelf deposits

Specialized Tools to Study Ocean Sediments

- Clamshell sampler
- Piston corer

Samples are relatively undisturbed.



Sediments Are Historical Records of Ocean Processes

- Stratigraphy – analysis of layered deposits
- Paleoceanography – study of the ocean's past
 - Microfossils
 - Dating deep-sea sediments
 - Relative analysis of stable isotopes

Marine Sediments Are Economically Important

- Components of building materials
- Crude oil and natural gas
- Sand and gravel
- Manganese nodules