

Sedimentary Rocks

- a rock resulting from the consolidation of loose sediment that has been derived from previously existing rocks
- a rock formed by the precipitation of minerals from solution

Sedimentary Stages of the Rock Cycle

Weathering

Erosion

Transportation

Deposition (sedimentation)

Burial

Diagenesis

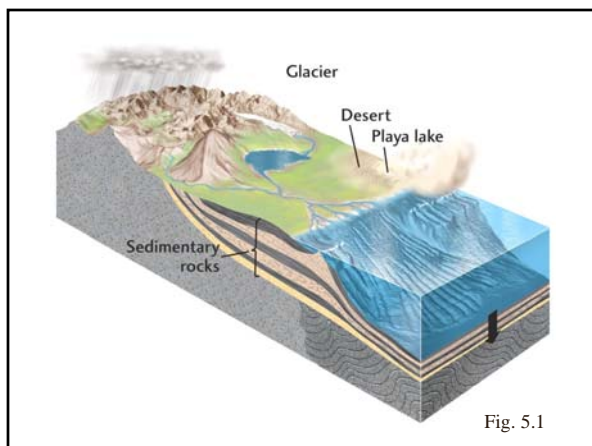


Table 8.1 Minerals Remaining in Clastic Sediments Derived from an Average Granite Outcrop Under Varying Intensities of Weathering

INTENSITY OF WEATHERING		
Low	Medium	High
Quartz	Quartz	Quartz
Feldspar	Feldspar	Clay minerals
Mica	Mica	
Pyroxene	Clay minerals	
Amphibole		

Table 5.1

Sorting



Well-sorted sand

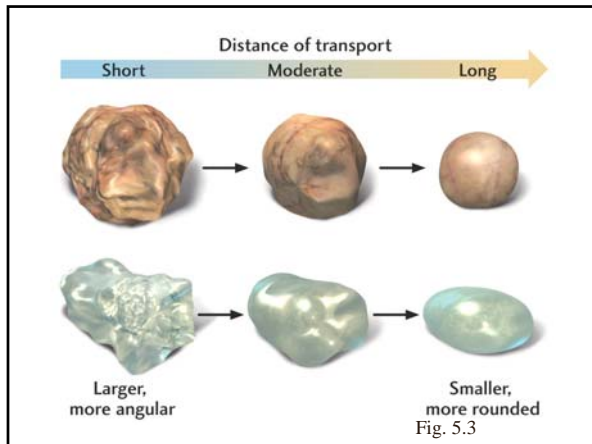
Poorly sorted sand

Fig 5.2

Transport will effect the sediment in several ways

Sorting: a measure of the variation in the range of grain sizes in a rock or sediment

- Well-sorted sediments have been subjected to prolonged water or wind action.
- Poorly-sorted sediments are either not far-removed from their source or deposited by glaciers.



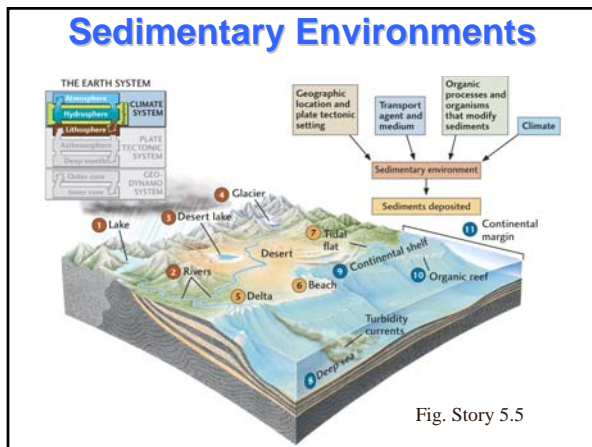


Table 8.2 Major Chemical and Biochemical Sedimentary Environments

Environment	Agent of Precipitation	Sediments
SHORELINE AND MARINE		
Carbonate (includes reef, bank, deep sea, etc.)	Shelled organisms, some algae; inorganic precipitation from seawater	Carbonate sands and muds, reefs
Evaporite	Evaporation of seawater	Gypsum, halite, other salts
Siliceous: deep sea	Shelled organisms	Silica
CONTINENTAL		
Evaporite	Evaporation of lake water	Halite, borates, nitrates, other salts
Swamp	Vegetation	Peat

Table 5.2

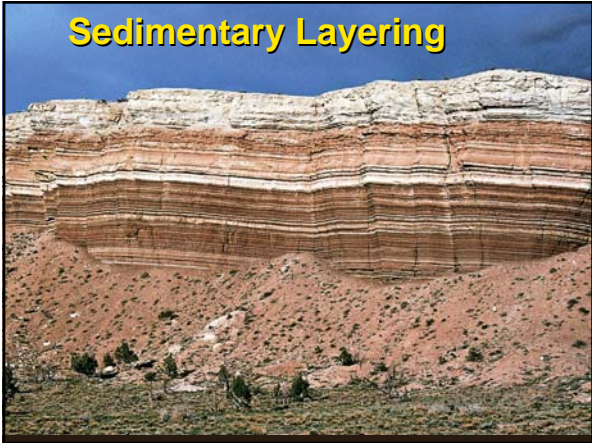
Sedimentary Structures

Stratification = Bedding = Layering

This layering that produces sedimentary structures is due to:

- Particle size
- Types (s) of particles

Sedimentary Layering



Other Examples of Sedimentary Structures

- Cross-beds
- Ripple marks
- Mudcracks
- Raindrop impressions
- Fossils

Cross-bedded sandstone



Fig. 5.6

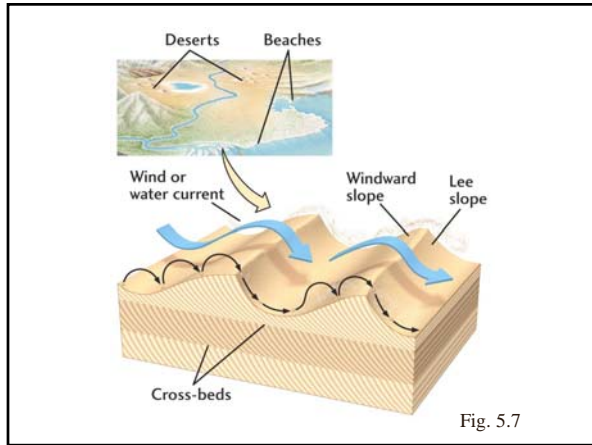


Fig. 5.7

Ripples on a beach

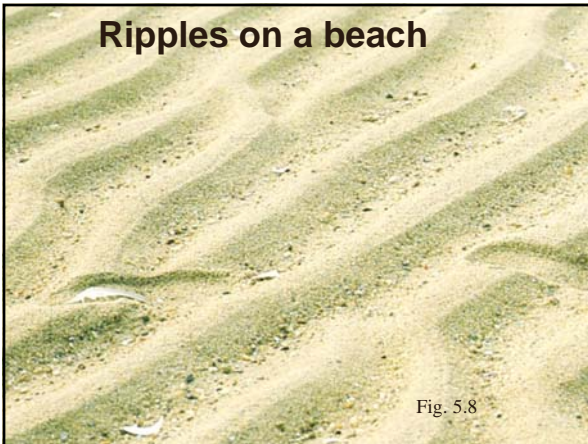
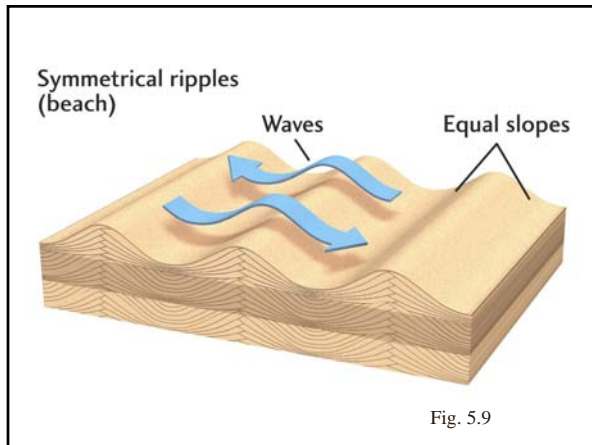
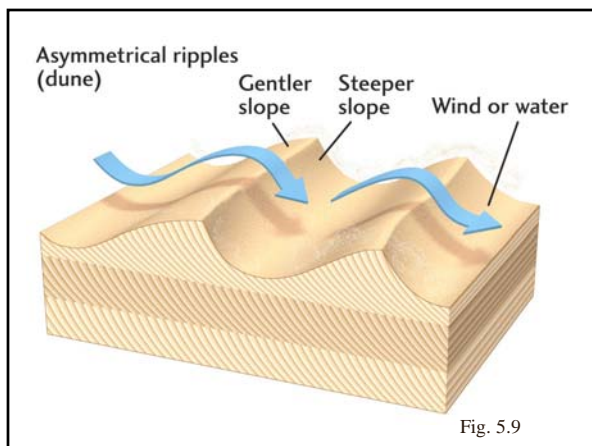


Fig. 5.8

Ripples Preserved in Sandstone









Turbidity Currents

Suspension of water sand, and mud that moves downslope (often very rapidly) due to its greater density than the surrounding water (often triggered by earthquakes).

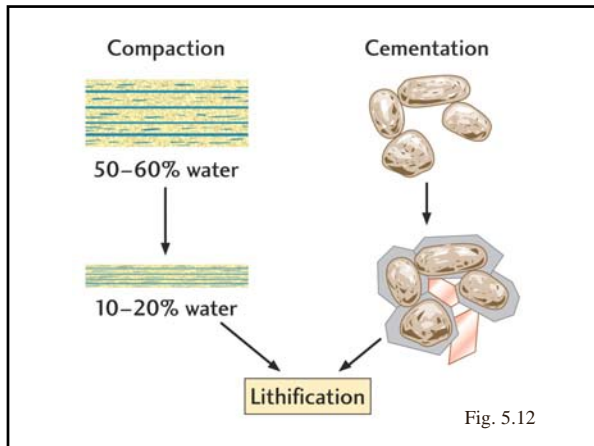
The speed of turbidity currents was first appreciated in 1920 when a current broke lines in the Atlantic. This event also demonstrated just how far a single deposit could travel.

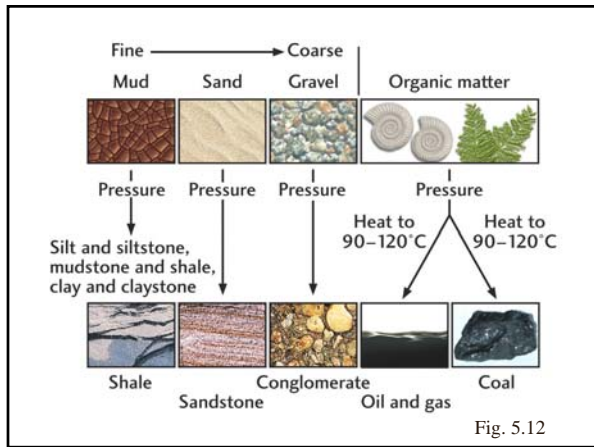
From Sediment to Sedimentary Rock (lithification)

Compaction: reduces pore space. clays and muds are up to 60 % water; 10% after compaction

Cementation: chemical precipitation of mineral material between grains (SiO_2 , CaCO_3 , Fe_2O_3) binds sediment into hard rock.

Recrystallization: Pressure and Temperature increase with burial ($30^\circ\text{C}/\text{km}$ or $1^\circ\text{C}/33\text{ m}$).





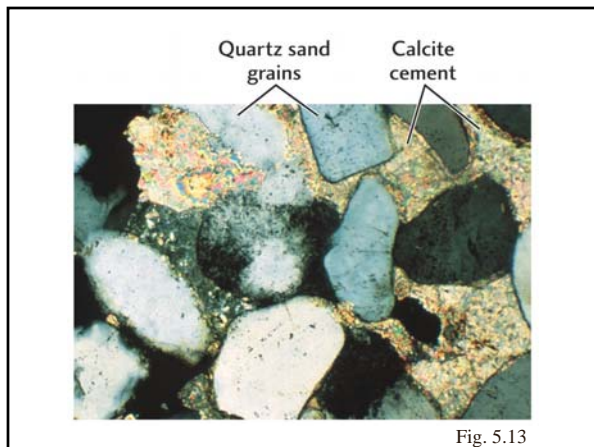


Table 8.3. Major Classes of Clastic Sediments and Sedimentary Rocks

Particle Size	Sediment	Rock
COARSE Larger than 256 mm (about 10 in.) 256–64 mm (about 2.5 in.) 64–2 mm (about 0.08 in.; actual size about ●)	GRAVEL Boulder	Conglomerate
	Cobble	
	Pebble	
MEDIUM 2–0.062 mm	SAND	Sandstone
FINE 0.062–0.0039 mm	MUD Silt	Siltstone
Finer than 0.0039 mm	Clay	Mudstone (blocky fracture) Shale (breaks along bedding) Claystone

Table 5.3

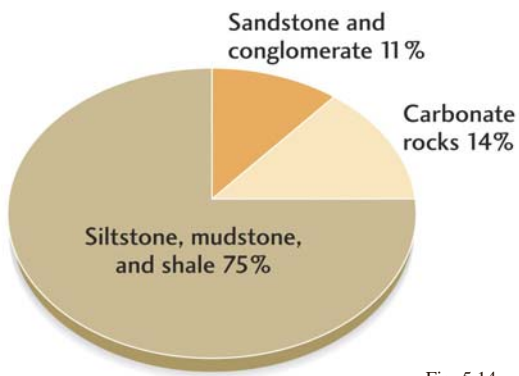


Fig. 5.14

Clastic Sedimentary Rocks: Conglomerate



Fig. 5.15

Clastic Sedimentary Rocks: Sandstone



Fig. 5.15

Clastic Sedimentary Rocks: Shale



Fig. 5.15

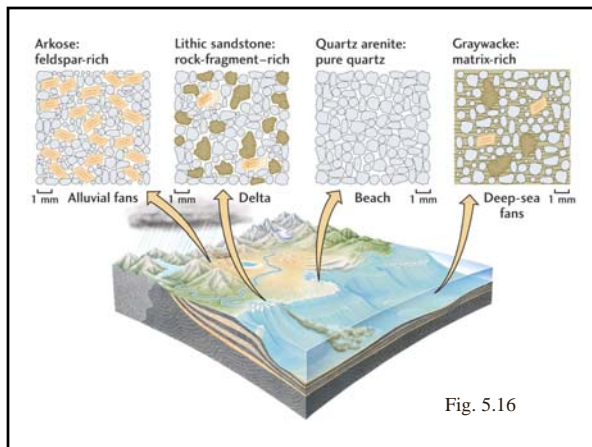


Fig. 5.16

Table 8.4 Classification of Biochemical and Chemical Sediments and Sedimentary Rocks

Sediment	Rock	Chemical Composition	Minerals
BIOCHEMICAL Sand and mud (primarily bioclastic)	Limestone	Calcium carbonate (CaCO ₃)	Calcite (aragonite)
Siliceous sediment	Chert	Silica (SiO ₂)	Opal, Chalcedony, Quartz
Peat, organic matter	Organics	Carbon compounds Carbon compounded with oxygen and hydrogen	(Coal), (Oil), (Gas)
CHEMICAL No primary sediment (formed by diagenesis)	Dolostone	Calcium-magnesium carbonate (CaMg[CO ₃] ₂)	Dolomite
Iron oxide sediment carbonate	Iron formation	Iron silicate; oxide (Fe ₂ O ₃);	Hematite, Limonite, Siderite
Evaporite sediment	Evaporite	Sodium chloride (NaCl); calcium sulfate (CaSO ₄)	Gypsum, Anhydrite, Halite, Other salts
No primary sediment (formed by diagenesis)	Phosphorite (Ca ₃ PO ₄) ₂	Calcium phosphate	Apatite

Table 5.4

Composition of Sedimentary Rocks

limestone	CaCO₃
chert	SiO₂
salt	NaCl, KCl, K₂SO₄
gypsum	CaSO₄ • 2H₂O
coal	altered organic debris

**Chemical Environments:
Carbonates**

clear water — away from big rivers
(or volcanoes)

warm water — subtropical to tropical
shallow water, two reasons:

organic: sunlight only penetrates
to about 100 m

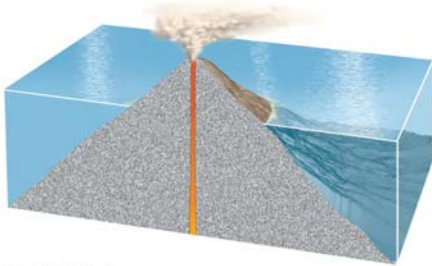
inorganic: CCD (dissolution of
CaCO₃ dependant on *P*)

Chemical Sedimentary Rocks: Limestone



Fig. 5.17

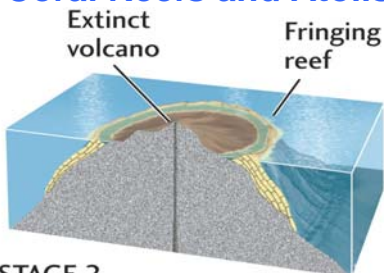
Coral Reefs and Atolls



STAGE 1
A volcano rises from ocean floor.

Box 5.1

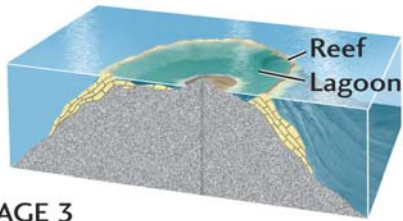
Coral Reefs and Atolls



STAGE 2
The volcano becomes extinct and erodes. A fringing reef forms.

Box 5.1

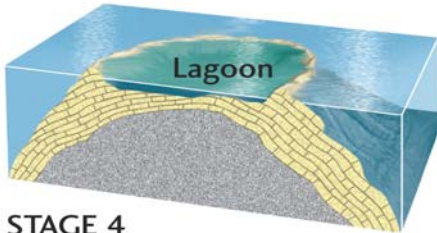
Coral Reefs and Atolls



STAGE 3
The oceanic plate subsides, carrying the volcanic island with it. The reef builds up, keeping pace with rising sea level.

Box 5.1

Coral Reefs and Atolls



STAGE 4
As subsidence continues, the reef completely covers the buried volcanic island.

Box 5.1

Reefal Limestone



Fig. 5.19

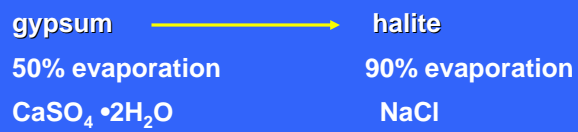
Chemical Sedimentary Rocks: Chert



Fig. 5.17

Chemical Environments: Evaporites

- Found only in restricted environments (Mediterranean Sea, Texas Coast)
- Minerals precipitate according to solubility



Great Salt Lake



Chemical Sedimentary Rocks: Gypsum



Fig. 5.17

Chemical Sedimentary Rocks: Halite



Fig. 5.17

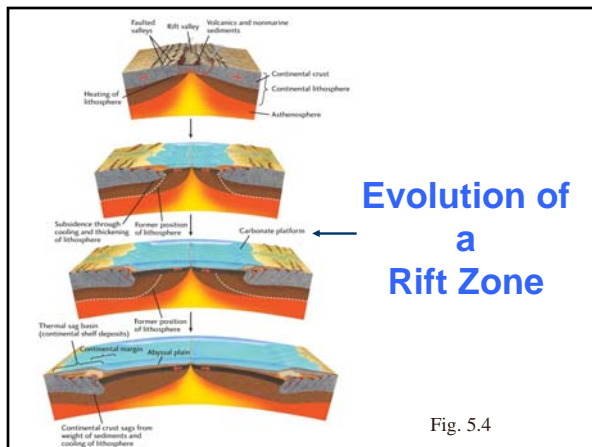


Fig. 5.4
