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

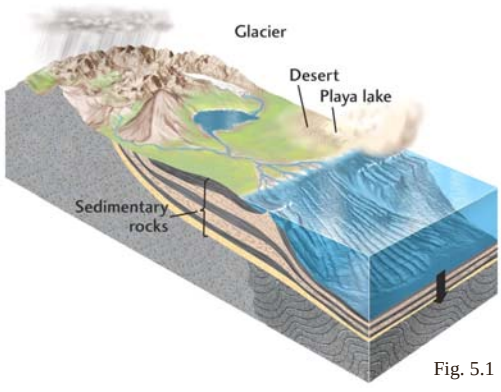


Fig. 5.1

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.

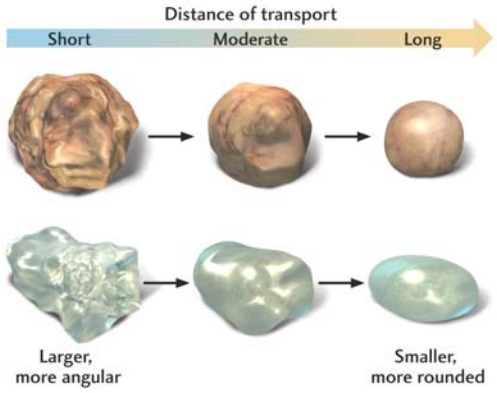


Fig. 5.3

Sedimentary Environments

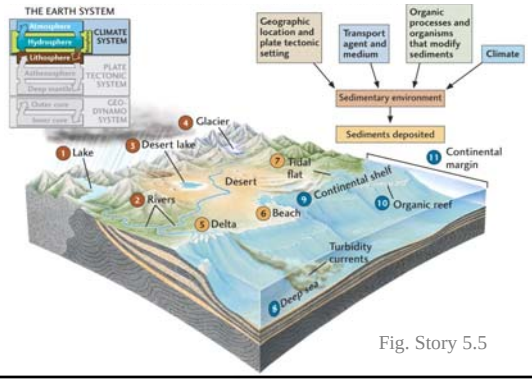


Fig. Story 5.5

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

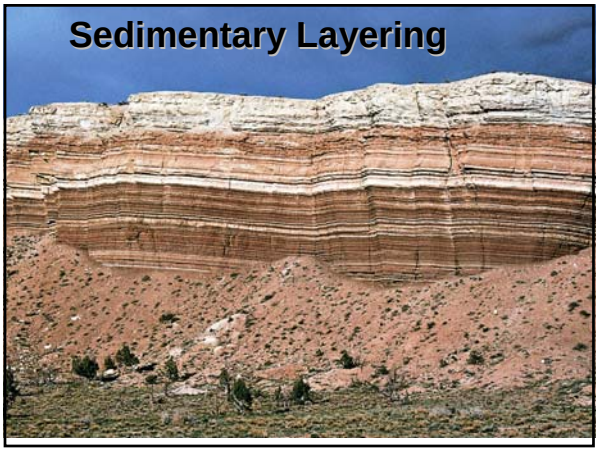
Sedimentary Structures

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

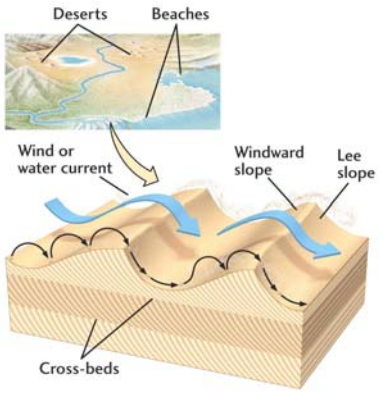


Fig. 5.7

Ripples on a beach

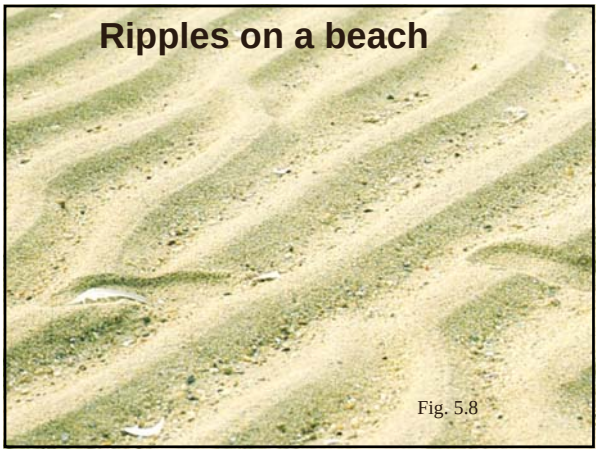


Fig. 5.8

Ripples Preserved in Sandstone

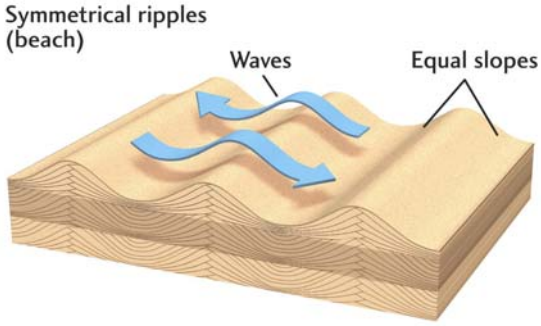


Fig. 5.9

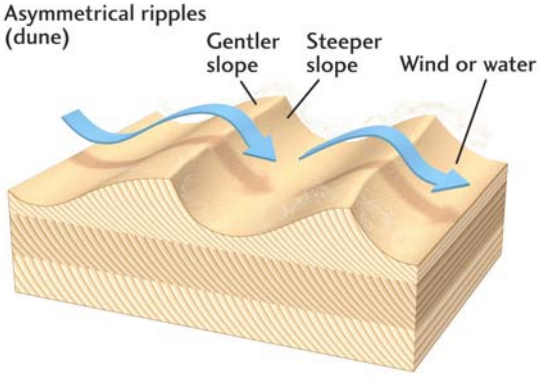


Fig. 5.9

Fig. 5.10

Turbidity Currents

Suspension of water sand, and mud that moves downslope (often very rapidly) due to its greater density that 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 Sock (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°C/km or 1°C/33 m).**

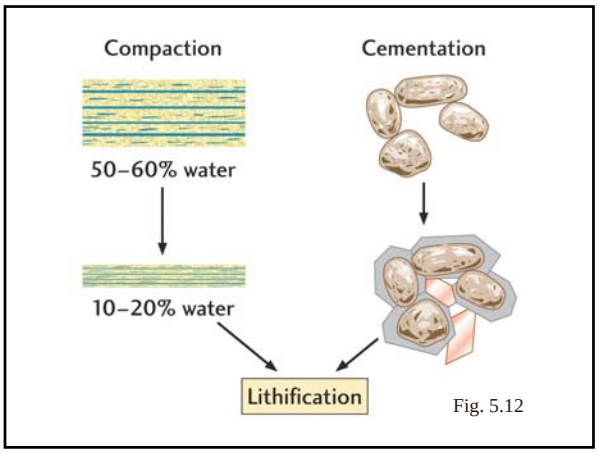


Fig. 5.12

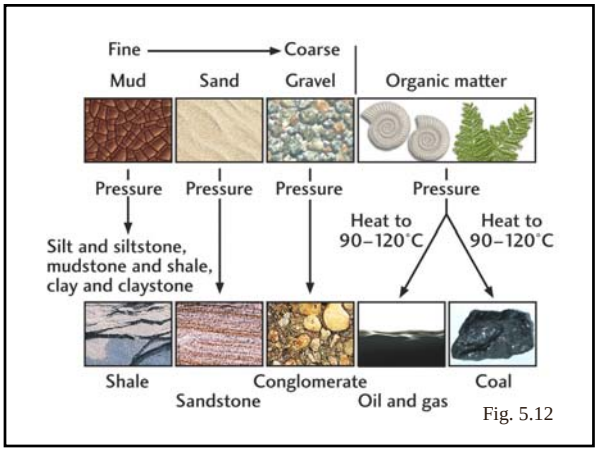


Fig. 5.12

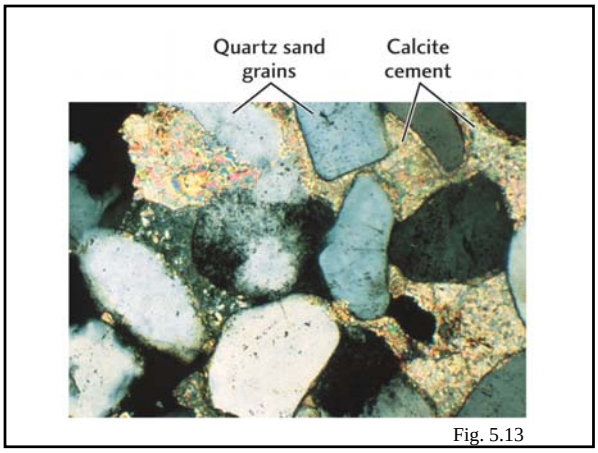


Fig. 5.13

Table 8.3 Major Classes of Clastic Sediments and Sedimentary Rocks

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

Table 5.3

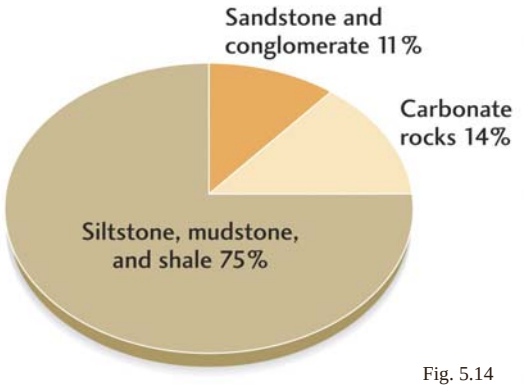


Fig. 5.14

Clastic Sedimentary Rocks: Conglomerate

Fig. 5.15

Clastic Sedimentary Rocks: Sandstone

Fig. 5.15

Clastic Sedimentary Rocks: Shale

Fig. 5.15

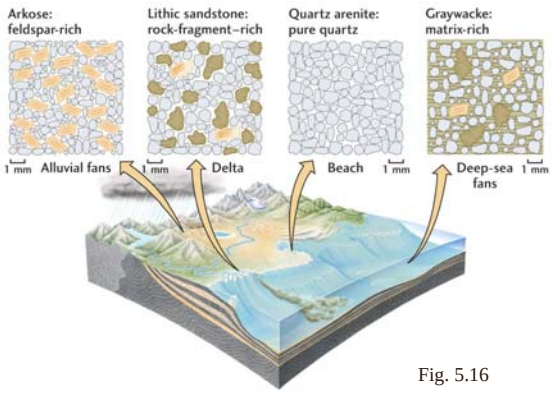


Fig. 5.16

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_2O_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	$CaCO_3$
chert	SiO_2
salt	NaCl, KCl, K_2SO_4
gypsum	$CaSO_4 \cdot 2H_2O$
coal	altered organic debris

Chemical Environments: Carbonates

clear water — away from big rivers (or volcanoes)

warm water — subtropical to tropical

shallow water, two reasons:

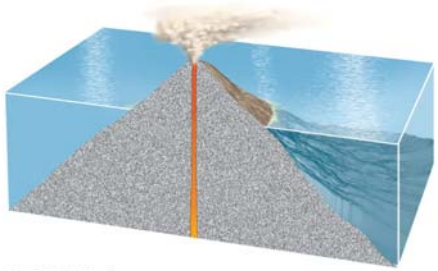
organic: sunlight only penetrates to about 100 m

inorganic: CCD (dissolution of $CaCO_3$ dependant on *P*)

Chemical Sedimentary Rocks: Limestone

Fig. 5.17

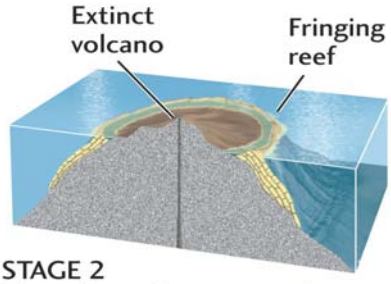
Coral Reefs and Atolls



STAGE 1
A volcano rises from ocean floor.

Box 5.1

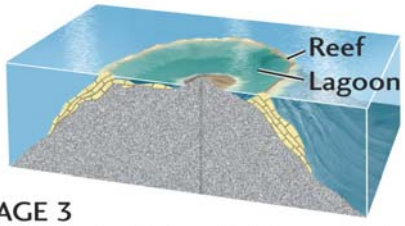
Coral Reefs and Atolls



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

Box 5.1

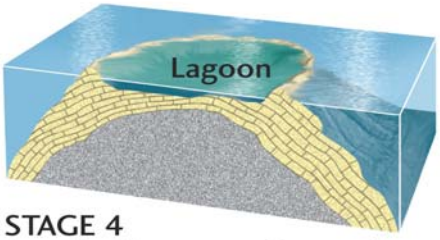
Coral Reefs and Atolls



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

gypsum		halite
50% evaporation	→	90% evaporation
$CaSO_4 \cdot 2H_2O$		NaCl

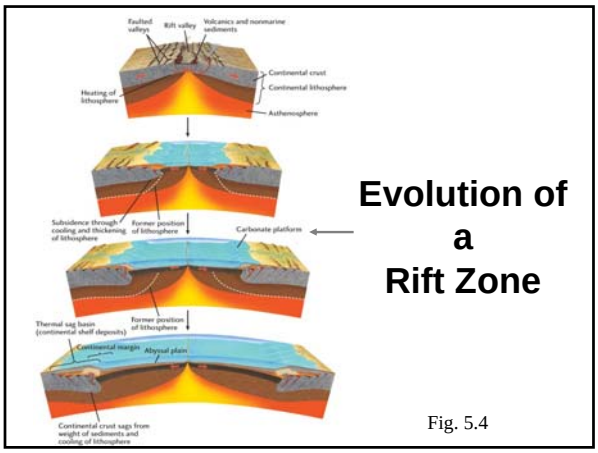
Great Salt Lake

Chemical Sedimentary Rocks: Gypsum

Fig. 5.17

Chemical Sedimentary Rocks: Halite

Fig. 5.17



Evolution of a Rift Zone

Fig. 5.4