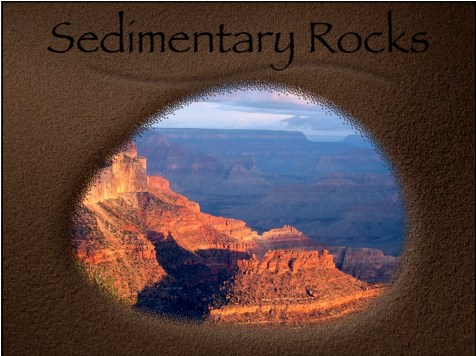


Any
Questions?

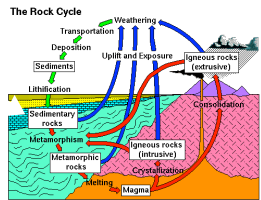
1

Sedimentary Rocks



2

Rock Cycle



3

Sedimentary Rock

Sedimentary rock is formed from either cemented preexisting particles or from minerals that precipitate at surface pressure and temperatures.

4

Sedimentary Rock



5

Sedimentary Rock

Sedimentary rock has many uses..



6

Sediment > Rock

- ▶ Weathering
- ▶ Transportation
- ▶ Deposition
- ▶ Lithification

7

Lithification

- ▶ Cementation
- ▶ Compaction
- ▶ Crystallization

8

Types of Sed. Rxs

- ▶ Detrital sedimentary rocks
- ▶ Chemical sedimentary rocks


9

Detrital Sedimentary Rocks			Chemical Sedimentary Rocks		
Clastic Texture Particle Size	Sediment Name	Rock Name	Composition	Texture	Rock Name
Coarse (over 2 mm)	Gravel (Rounded particles)	Conglomerate	Calcite, CaCO ₃	Nonclastic: Fine to coarse crystalline	Crystalline Limestone
	Gravel (Angular particles)	Breccia		Clastic: Well-sorted shells and shell fragments bound cemented	Travertine
Medium (1/16 to 2 mm)	Sand (If abundant halite to prevent the rock is called Arkose)	Sandstone		Clastic: Various sizes shells and shell fragments cemented with calcite cement	Cocquina
Fine (1/16 to 1/256 mm)	Mud	Siltstone		Clastic: Microscopic shells and clay	Fossiliferous Limestone
Very fine (less than 1/256 mm)	Mud	Shale	Quartz, SiO ₂	Nonclastic: Very fine crystalline	Chert (light colored) Fert (dark colored)
			Gypsum CaSO ₄ ·2H ₂ O	Nonclastic: Fine to coarse crystalline	Rock Gypsum
			Halite, NaCl	Nonclastic: Fine to coarse crystalline	Rock Salt
			Absent plant fragments	Nonclastic: Fine-grained organic matter	Bituminous Coal

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Detrital Sed. Rxs.

- ▶ Detrital sedimentary rocks
 - ▶ Based on grain size and not composition
 - ▶ There are conglomerates or breccias, sandstones, silts and shales or mudstones.
- ▶ Sediments are deposited under the influence of gravity, so they tend to form broad horizontal sheets called STRATA



11



Strata




12

Detrital Sedimentary Rocks		
Clastic texture Particle Size	Sediment Name	Rock Name
Coarse (over 2 mm)	Gravel (Rounded particles)	Conglomerate
	Gravel (Angular particles)	Breccia
Medium (1/16 to 2 mm)	Sand (If abundant feldspar is present the rock is called Arkose)	Sandstone
Fine (1/16 to 1/256 mm)	Silt	Siltstone
Very fine (less than 1/256 mm)	Mud	Shale

▲ "Sand" is a size term - not a mineral term. Sand isn't always quartz.

▲ "Clay" is used in two ways. The word may represent "clay minerals" or it may represent "clay grain size".

13

Conglomerate



Rounded fragments - mixed matrix.

14

Breccia



Angular fragments - mixed matrix.

15

Sandstone



This example is a quartz sandstone.

16

Sand is found in many environments.
For example, sand in these sand dunes...



17

might eventually be lithified into a
sandstone in the geologic record.



18

Siltstone + Shale/Mudstone

Over 50% of all sedimentary rocks!!!

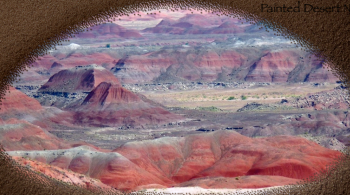


Shale may be black, indicating it is rich in organic
compounds. This shale also has plant fossils.

19

Siltstone + Shale/Mudstone

Painted Desert NE Arizona



Shale/Mudstone may also be colorful, as are
these paleosols (ancient soils).

20



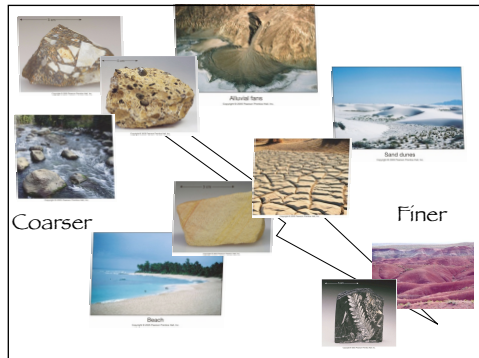
21

Distance from Source

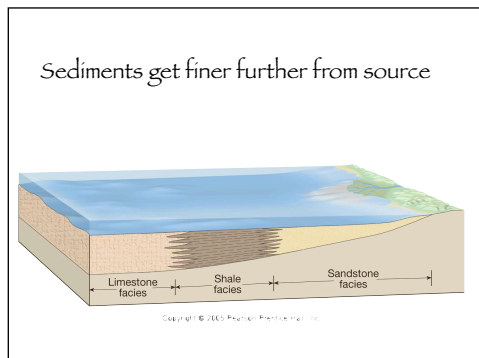
In general, the farther you are from the erosional source of sediment, the finer grained the sediment (because of mechanical and chemical weathering). So, very coarse sediments, like conglomerates, are deposited close to sources, while very fine-grained sediments, like clay, are deposited further away.

In the geologic record, then, when you find conglomerates they were probably deposited near an ancient sediment source, but shales or mudstones were deposited at some distance from the source.

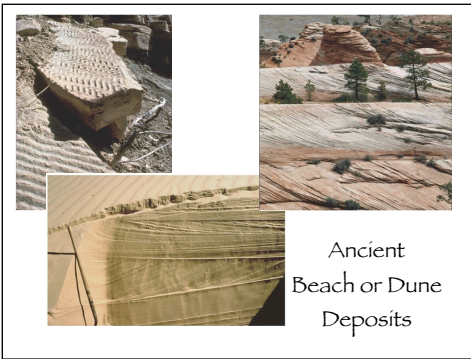
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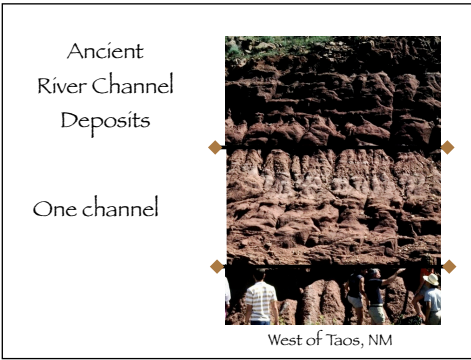


24



Ancient
Beach or Dune
Deposits

25

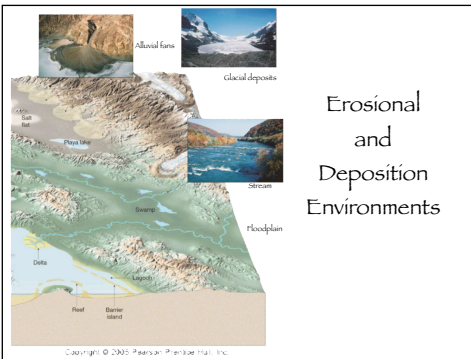


Ancient
River Channel
Deposits

One channel

West of Taos, NM

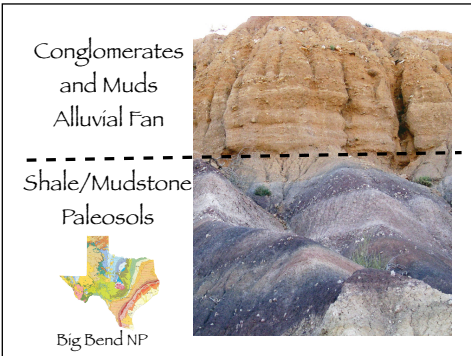
26



Erosional
and
Deposition
Environments

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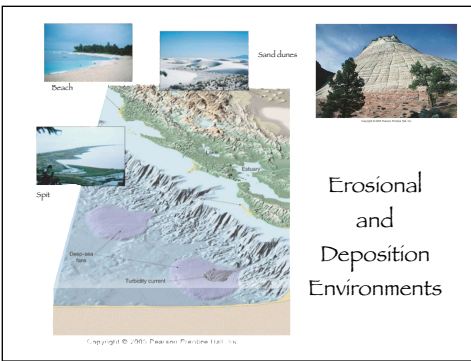
Conglomerates
and Muds
Alluvial Fan

Shale/Mudstone
Paleosols



Big Bend NP

28



29

Chemical Sedimentary Rocks

Chemical sedimentary rocks are formed at surface temperatures and pressures either through organic or inorganic processes. Salts are inorganic, but many marine organisms precipitate calcite in the form of skeletons or microscopic needles. Coal is a type of chemical sedimentary rock formed of the organic remains of plant material.

30

Chemical Sedimentary Rocks		
Composition	Texture	Rock Name
Calcite, CaCO ₃	Nonclastic: Fine to coarse crystalline	Crystalline Limestone Travertine
	Clastic: Visible shells and shell fragments loosely cemented	Coquina
	Clastic: Various size shells and shell fragments cemented with calcite cement	Fossiliferous Limestone
	Clastic: Microscopic shells and clay	Chalk
Quartz, SiO ₂	Nonclastic: Very fine crystalline	Chert (light colored) Flint (dark colored)
Gypsum CaSO ₄ ·2H ₂ O	Nonclastic: Fine to coarse crystalline	Rock Gypsum
Halite, NaCl	Nonclastic: Fine to coarse crystalline	Rock Salt
Altered plant fragments	Nonclastic: Fine-grained organic matter	Bituminous Coal

Chemical Sedimentary
RXS

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Chemical Sedimentary Rocks		
Composition	Texture	Rock Name
Calcite, CaCO ₃	Nonclastic: Fine to coarse crystalline	Crystalline Limestone Travertine
	Clastic: Visible shells and shell fragments loosely cemented	Coquina
	Clastic: Various size shells and shell fragments cemented with calcite cement	Fossiliferous Limestone
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Halite, NaCl	Nonclastic: Fine to coarse crystalline	Rock Salt
Altered plant fragments	Nonclastic: Fine-grained organic matter	Bituminous Coal

Typical
Chemical Sed.
Rxs

- ▲ Limestones
- ▲ Chert
- ▲ Evaporites
- ▲ Coal

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Limestones

Limestones are the most abundant chemical sedimentary rocks. They are mostly made of calcite. Limestones usually form at sea, but some form in lakes or caves where there is much dissolved calcite. They are either organic or inorganic in origin.



White Cliffs of Dover, England

33



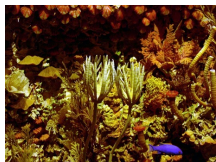
In central Texas abundant limestones are resistant to weathering and form many cliffs.

34

These thick limestones in Big Bend National Park represent extensive carbonate shelves, like the Bahamas today!



35



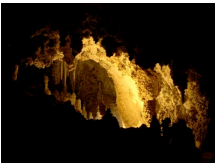
Fossil reefs are largely made of skeletal remains of organisms.

El Capitan
West
Texas



36

Carlsbad Caverns NP,
New Mexico



Limestone can also form in caves because of active calcite precipitation.

37



Organic limestones form either from precipitation of calcite by bacteria or by cementation of calcite seashells.



Close up

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Chert

Chert is a microcrystalline silica, whose common names include flint and agate. Chert can form on the ocean floor, but usually forms in the sediment long after deep sea sediments have been buried.

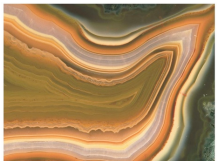
Chert (and its varieties) has always been important for the production of stone tools.

Flint was also important in early firearms because it easily made sparks to touch off gunpowder.

Chert



39



Agate

Chert colors reflect tiny chemical impurities with the quartz, frequently iron or sulfur.

40

Evaporites

Evaporites form when large bodies of water evaporate. This has happened in the Mediterranean Sea and in the early Gulf of Mexico. When vast amounts of salty sea water evaporate, various salts are left behind and these can be hundreds to thousands of feet thick. Evaporites include rock salt and gypsum. Since these rocks form by the evaporation of water they are called evaporites.



41



Modern salt is usually mined, but in many places it is also 'harvested' from evaporating seawater.

42



43

Permian Basin



The evaporites you saw in the last slide were produced when, about 250 million years ago, the Permian Basin was closed off from the Panthalassic Ocean and it evaporated!

44

Mediterranean

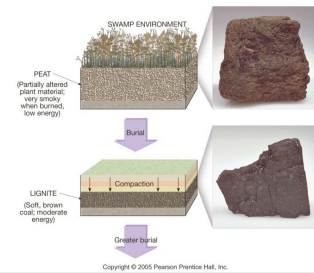
About 6 million years ago, the entire Mediterranean Sea was closed off at the Straights of Gibraltar and totally evaporated. This resulted in thousands of feet of salt and gypsum being evaporated out on it's floor.



45

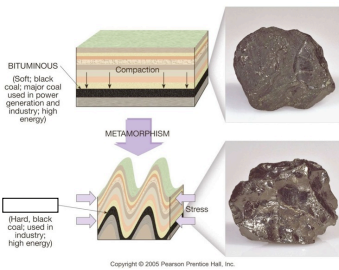
Coal

▶ Coal forms from compressed vegetable matter.



46

Coal



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In Summary.....

- ▶ Chemical and Nonchemical Sed. Rxs.
- ▶ Nonchemical sed. rock names based on grain size and then grain shapes.
- ▶ Chemical sed. rock names based mainly on chemistry.
- ▶ Different sed. rocks are deposited in different environments and always carry clues as to their genesis.

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