Sedimentary Rocks
S=slide

S1
Importance of Sedimentary Rocks – Most of the Earth's surface, including the ocean basins, is covered by sediment. Contains a record of past conditions and events at the surface of the earth, including fossils.

S2
Origins of Sedimentary Rock
Weathering

Soluble constituents carried by streams & groundwater, solid particles moved by gravity, water, wind, & ice

Deposition of solid particles – slowing currents
sedimentary from sedimentum (Latin) -> to settle

Deposition of material dissolved in water – ions in solution removed from solution due to chemical or temperature changes or by organisms

Diagenesis -> lithification and cementation leads to sedimentary rock

S3
Sedimentary Rock Categories
Detrital sedimentary rocks – deposits of solid particles derived from mechanical and chemical weathering

Chemical sedimentary rocks – precipitation of ions in solution by inorganic or biologic processes

Organic sedimentary rocks – undecayed plant material accumulated on the floors of swamps

S4
Detrital Sedimentary Rocks

S5
Particle size
Primary basis for distinguishing various detrital sedimentary rocks

Clay is a particle size as well as a mineral

Currents sort particles by size – the stronger the current the larger the particle size carried

S6
Mass Wasting and Deposition
Sediment grains transported by a landslide

S7
Breccia
Large particles with angular edges
Edges are not rounded indicating they did not travel far from the source area before being deposited

S8
Conglomerate
Primarily gravels that range in size from large boulders to particles the size of garden peas
Poorly sorted because the spaces between the larger particles are filled with smaller particles – sand or mud

S9
Sandstone
Sorting
Particle shape
Composition

S10
Sorting and Particle Shape
Figure

S11
Magnified view of quartz sand from a sand dune in Saudi Arabia. Grain sizes are limited to a narrow range of sand.

S12
Sand ripples due to wind

S13
Eolian sand dunes surmounted by smaller wind ripples.
Death Valley, CA.

S14
Wind that is rich in transported silt

S15
Shale

S16
Chemical Sedimentary Rocks

S17
Precipitation of Material
Inorganic processes – evaporation and chemical activity can produce chemical sediments
dripstone in caves
salt
Organic (life) processes – water-dwelling organisms – *biochemical origin* – plants & animals extract dissolved mineral matter to form shells and hard parts
coquina
chalk

S18
Limestone
Limestone is the most abundant chemical sedimentary rock
It is composed of calcite ($CaCO_3$)
Forms by inorganic and biochemical processes in a variety of conditions
Carbonate reefs – invertebrate animals secrete a calcareous external skeleton
corals, algae, sponges, and bryozoans
Develop in warm, shallow water and are present in the rock record

S19
Bioclastic

S20
Coquina
Rock composed of poorly cemented shells and shell fragments

S21
Chalk
Soft, porous rock composed almost entirely of microscopic marine organisms smaller than the head of a pin

S22
Forams

S23
Inorganic Limestone
Travertine – commonly seen in caves deposited by groundwater

Oolitic limestone – composed of small spherical grains (ooids). Ooids form in shallow marine water as tiny particles are washed back and forth by currents – water is saturated with calcium carbonate
Dolostone –calcium-magnesium carbonate

S24
Chert
Microcrystalline quartz – flint, jasper, agate

Bedded chert – layered deposits form from the remains of diatoms and radiolarians (tiny silica shell organisms) in the ocean or associated with volcanic ash and lava
Nodules – spherical masses – secondary deposit due to reworking of material in limestone

S25
chert (chemical): composed of inorganically-precipitated, microcrystalline quartz.

S26
Diatoms and radiolarians are similar to forams in size

S27
Evaporite
Halite – rock salt
Gypsum – rock gypsum
Borates – Borax
Forms when a body of water evaporates
The minerals precipitate in a sequence determined by solubility
Less soluble minerals precipitate first – for example gypsum precipitates when 80% of seawater has evaporated and halite when 90% of seawater has evaporated

S28
A playa with white evaporite mineral deposits.
Racetrack Playa, Death Valley, CA.

S29
Organic Sedimentary Rock – Coal
Coal is mostly organic material – plant material that has been altered
Deposits of plant material build up under conditions that prevent oxidation of the plant material i.e., a swamp
Stagnant swamp water is low in oxygen so the plant material does not completely decay (oxidation)

S30
Cypress swamp.
Florida.

S31
Peat – layer of soft brown plant material

Lignite – soft brown coal that forms from burial of the peat

Burial increases temperature and higher temperatures bring chemical reactions that release water and organic gases and the proportion of carbon remaining increases

S32
Changing sediment to sedimentary rock

S33
Diagenesis is the term for the chemical, physical, and biological changes that take place after sediments are deposited and during and after lithification
less than 200°C
recrystallization

Lithification is the process by which unconsolidated sediments are transformed into solid sedimentary rocks

S34
Compaction is where the overlying material compresses the deeper sediments – the deeper buried the more compacted and firmer it becomes
reduction in pore space
water in pore spaces driven out

Cementation is the crystallization of minerals among the individual sediment grains
ions in solution in groundwater
crystallization in pore spaces cements clasts

S35
Classification of Sedimentary Rocks
Clastic – 'broken'
Crystalline – interlocking crystals

S36
Sedimentary Environments
History of a rock
Environment of deposition or sedimentary environment – origin of particles, the method of transport, and the nature of the place where the grains came to rest -
the setting where sediment accumulated

Study present environments to try to reconstruct past environments when the sediments were deposited – 'the present is the key to the past'

S37
Sedimentary Structures
Layers of sedimentary rock are called 'strata' or beds and are the most common feature

Separating the strata are bedding planes – flat surfaces where the rocks tend to break
Generally, each bedding plane marks the end of an episode of sedimentation

S38
When beds or strata are not horizontal
Found in sand dunes, river deltas, and some streams

S39
Cross bedding and ripples

S40
Graded Bedding (Layers)
In some environments sediments deposit in layers with larger sized debris dropping first and smaller debris settling out last
This is referred to as a graded bed (layer)

S41
Preserved Mud Cracks
Alternating wet and dry sediment

Associated with tidal flats, shallow lakes, and desert basins

S42
Burrows – type of fossil

S43
Trilobite Tracks – type of fossil

S44
Sedimentary Resources
Nonmetalic Mineral Resources – i.e., fluorite and limestone used to make steel, sand, clay, salt,

Coal – fossil fuel – from ancient plants

Oil and Natural Gas – fossil fuel from organisms

S45
Carbon Cycle and Sedimentary Rocks

S46
Key Concepts

1.Detrital sediments and sedimentary rocks

2.Chemical sediments and sedimentary rocks

3.How diagenesis, lithification, and cementation produce sedimentary rock

4.Sedimentary structures and how they are formed

5.Sedimentary environments