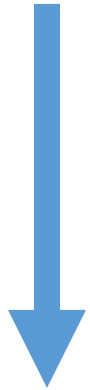


Sediment and Sedimentary Rock

Origin
Of
Sediments



Sedimentary
Rock

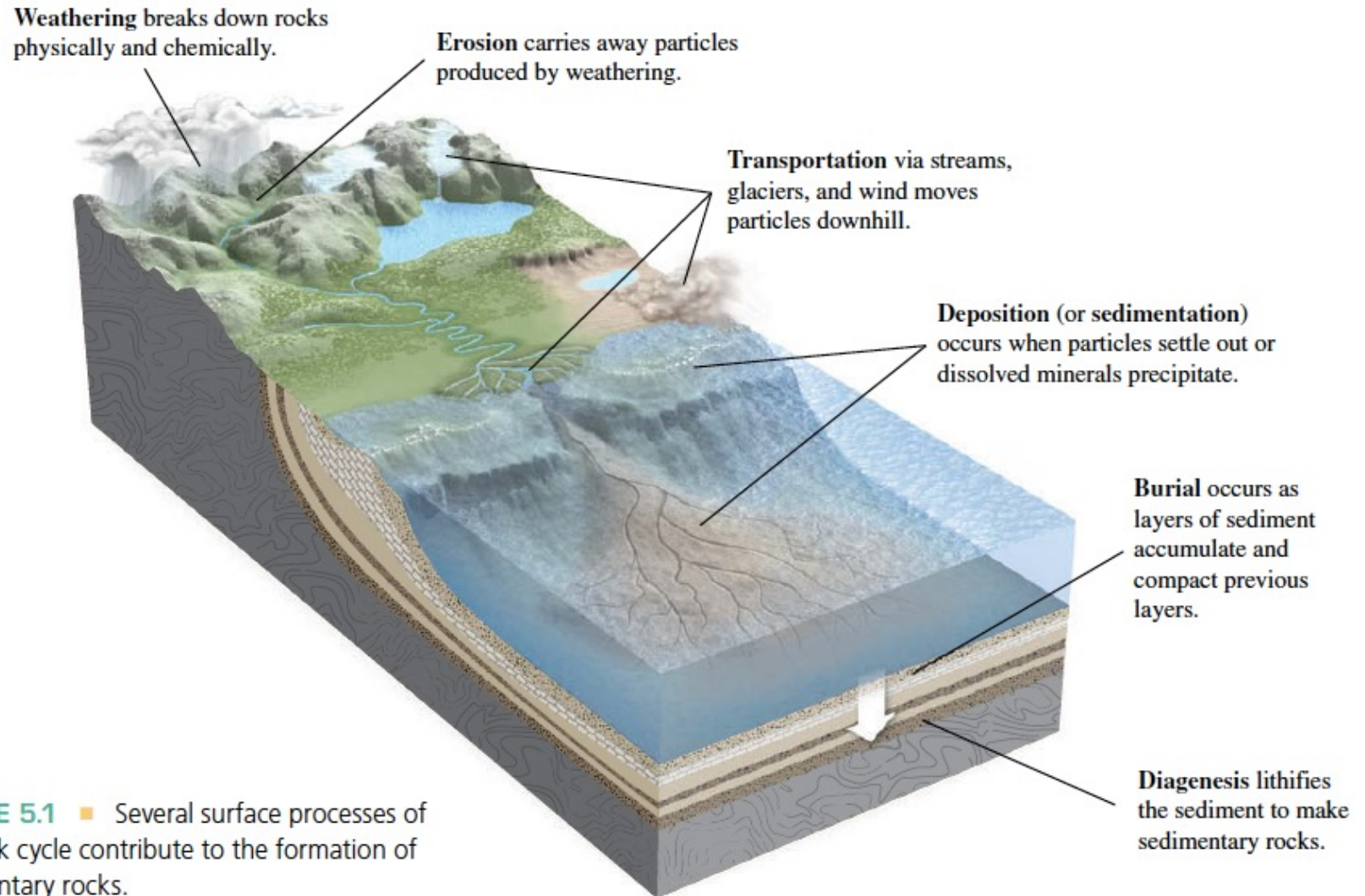


FIGURE 5.1 ■ Several surface processes of the rock cycle contribute to the formation of sedimentary rocks.

Weathering

Physical: Frost wedging, Thermal expansion, Biological activity

Chemical: Dissolution, Oxidation

Soil and Regolith

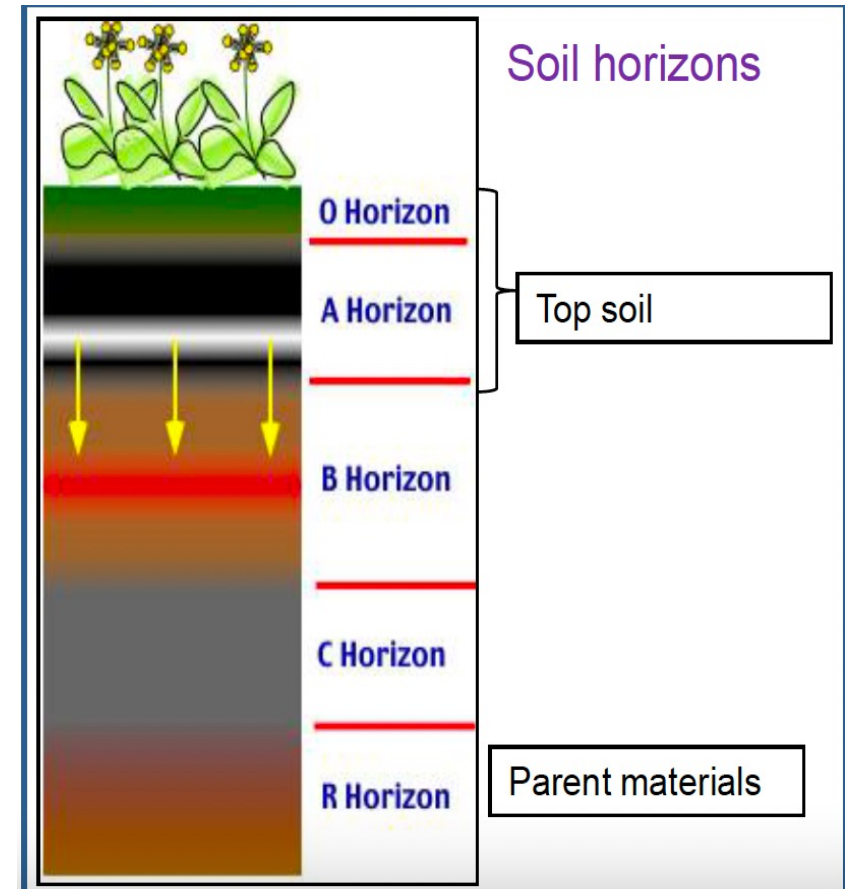
Weathering produces regolith (“rock blanket”) which is composed of small rock and mineral fragments.

When organic matter is mixed into this material it is called soil.

Soil

A combination of mineral and organic matter,
water and air

Layers



Erosion

Processes involving moving of rock material from one place to a new location (downhill) by transporting agents [*air, water, ice, gravity, etc.*]

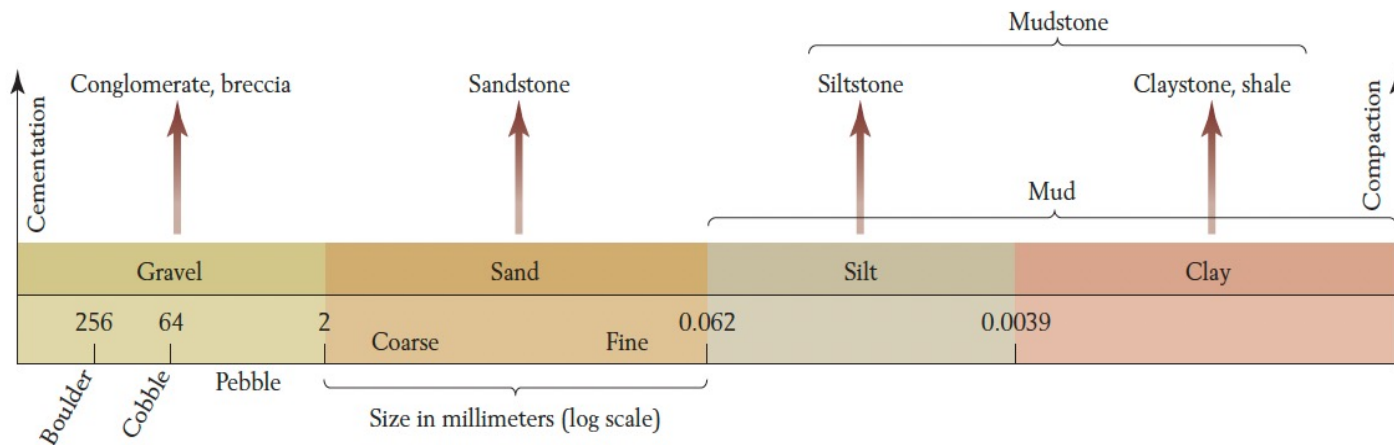
Agents of Erosion: flowing water, moving ice, waves, gravity, wind

SO, sediments are made out of rocks and are being transported downslope

Transportation of Sediments

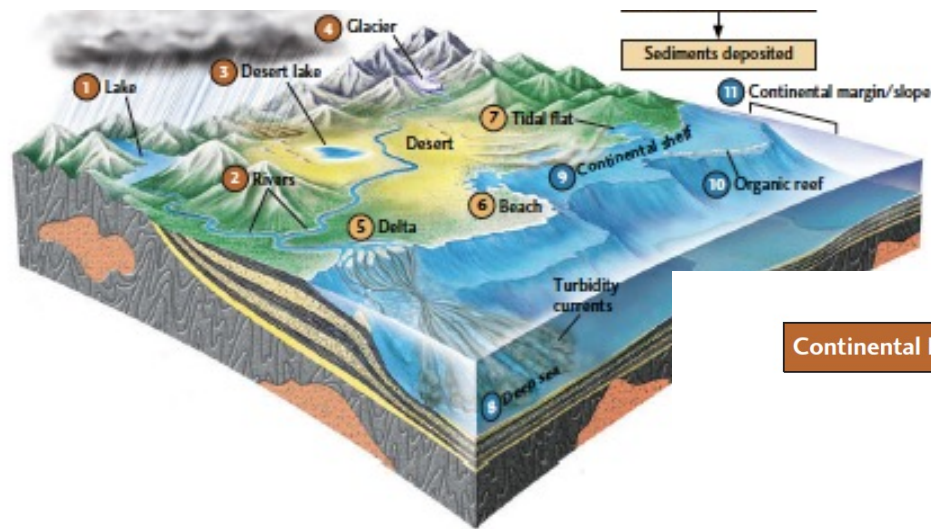
Size of Sediments

Scale of grain size: Φ
 $\Phi = -\log_2 (\text{grain size in mm})$



Particle Size	Sediment	Rock
Coarse-Grained	Gravel	
Larger than 256 mm	Boulder	Conglomerate
256–64 mm	Cobble	
64–2 mm	Pebble	
Medium-Grained		
2–0.062 mm	Sand	Sandstone
Fine-Grained	Mud	
0.062–0.0039 mm	Silt	Siltstone
		Mudstone (blocky fracture)
Finer than 0.0039 mm	Clay	Shale (breaks along bedding)
		Claystone

Depositional Environments



Continental Environments

Transport agent
Sediments

Climate
Biological processes

1 Lake	2 Alluvial	3 Desert	4 Glacial
Lake currents, waves	River currents	Wind	Ice, meltwater
Sand and mud, saline precipitates in arid climates	Sand, mud, and gravel	Sand and dust	Sand, mud, and gravel
Arid to humid	Arid to humid	Arid	Cold
Freshwater organisms and precipitates	Organic matter in muddy flood deposits and wetlands	Little biological activity	Little biological activity

Shoreline Environments

Transport agent
Sediments

Climate
Biological processes

5 Delta	6 Beach	7 Tidal flats
River currents, waves	Waves, tidal currents	Tidal currents
Sand and mud	Sand and gravel	Sand and mud
Arid to humid	Arid to humid	Arid to humid
Burial of plant debris	Little biological activity	Organisms mix sediments

Marine Environments

Transport agent

Sediments
Biological processes

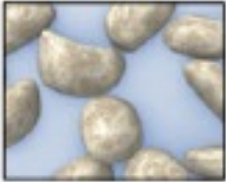
8 Deep sea	9 Continental shelf	10 Organic reefs	11 Continental margin/slope
Ocean currents Turbidity currents	Waves and tides	Waves and tides	Ocean currents and waves
Mud and sand	Sand and mud	Calcified organisms	Mud and sand
Deposition of remains of organisms	Deposition of remains of organisms	Secretion of carbonates by corals and other organisms	Deposition of remains of organisms

Sediments to Sedimentary Rocks

Compaction

Compaction by burial squeezes out water.

50–60% water



10–20% water

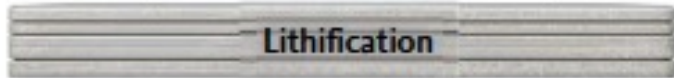


Cementation

Precipitation or addition of new minerals cements sediment particles.



Lithification



Types of Sediments

Based on origin, sediments can be classified into three types:

Inorganic	{	Clastic or detrital
		Chemical (may involve biological processes) – Limestone, Chert, Evaporites,
Organic -		Biological – coquina, coral

Clastic or detrital: weathering of preexisting rocks forms clastic particles that are transported and deposited.

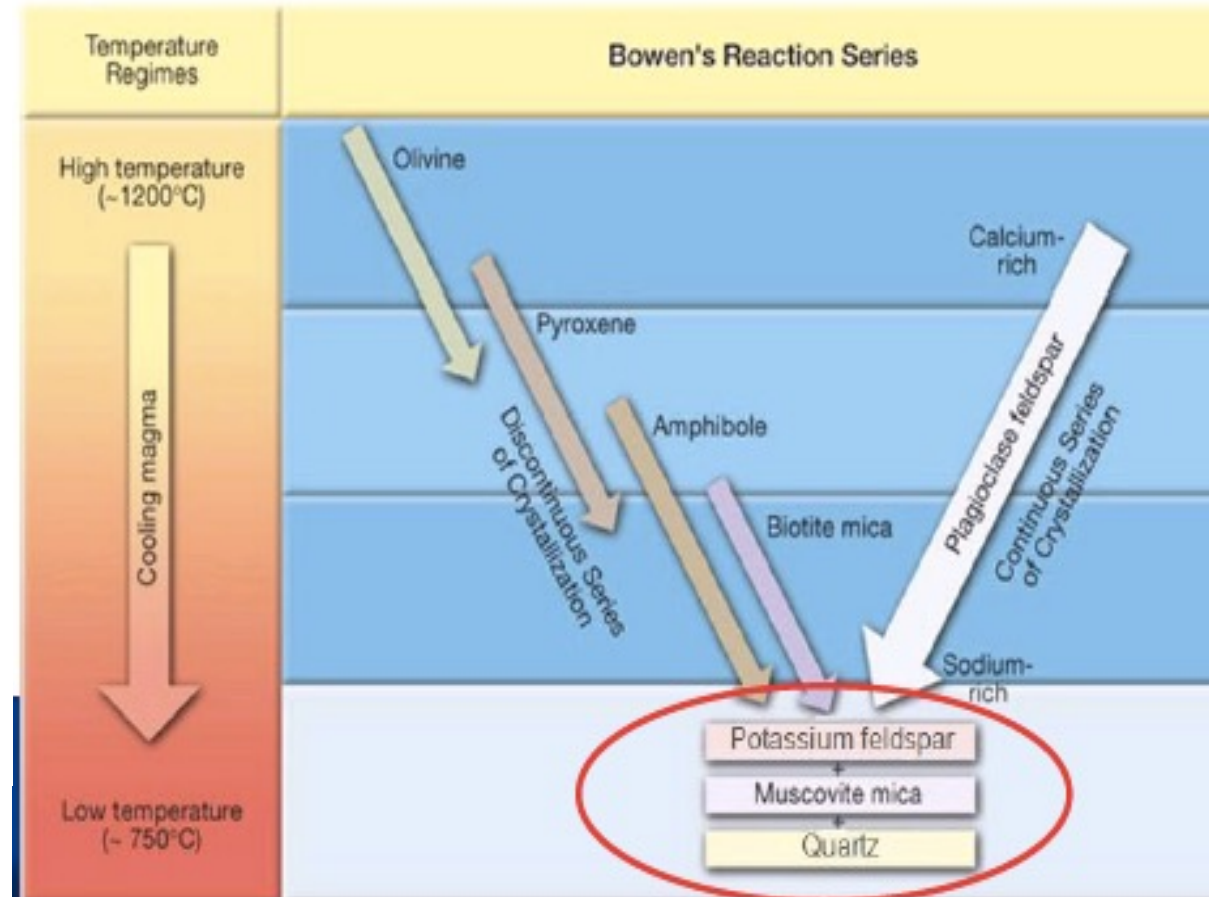
Chemical: weathering produces dissolved ions and molecules that form chemical sediments.

Transportation of Sediments

Composition of Sediments

Composition:
what are the minerals

Intensity of Weathering		
Low	Medium	High
Quartz	Quartz	Quartz
Feldspar	Feldspar	Clay minerals
Mica	Mica	
Pyroxene	Clay minerals	
Amphibole		



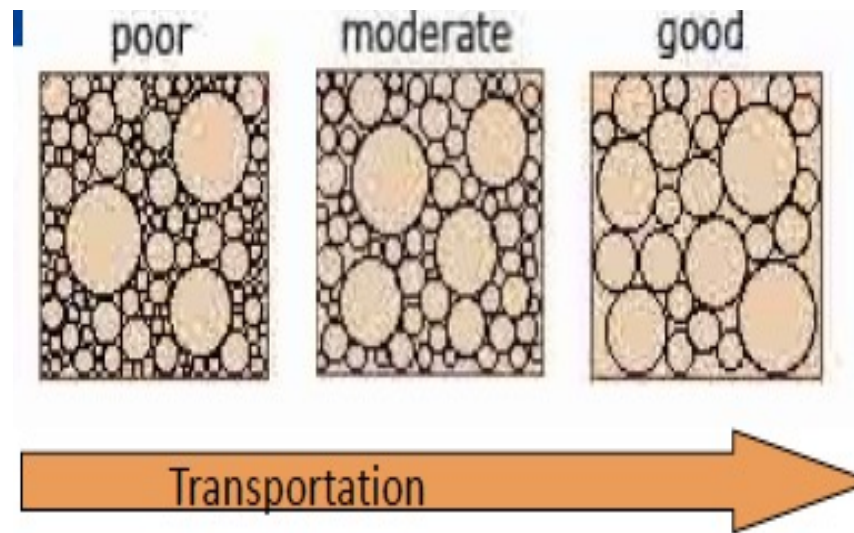
History of
weathering and
erosion?

Transportation of sediments

Sorting of Sediments

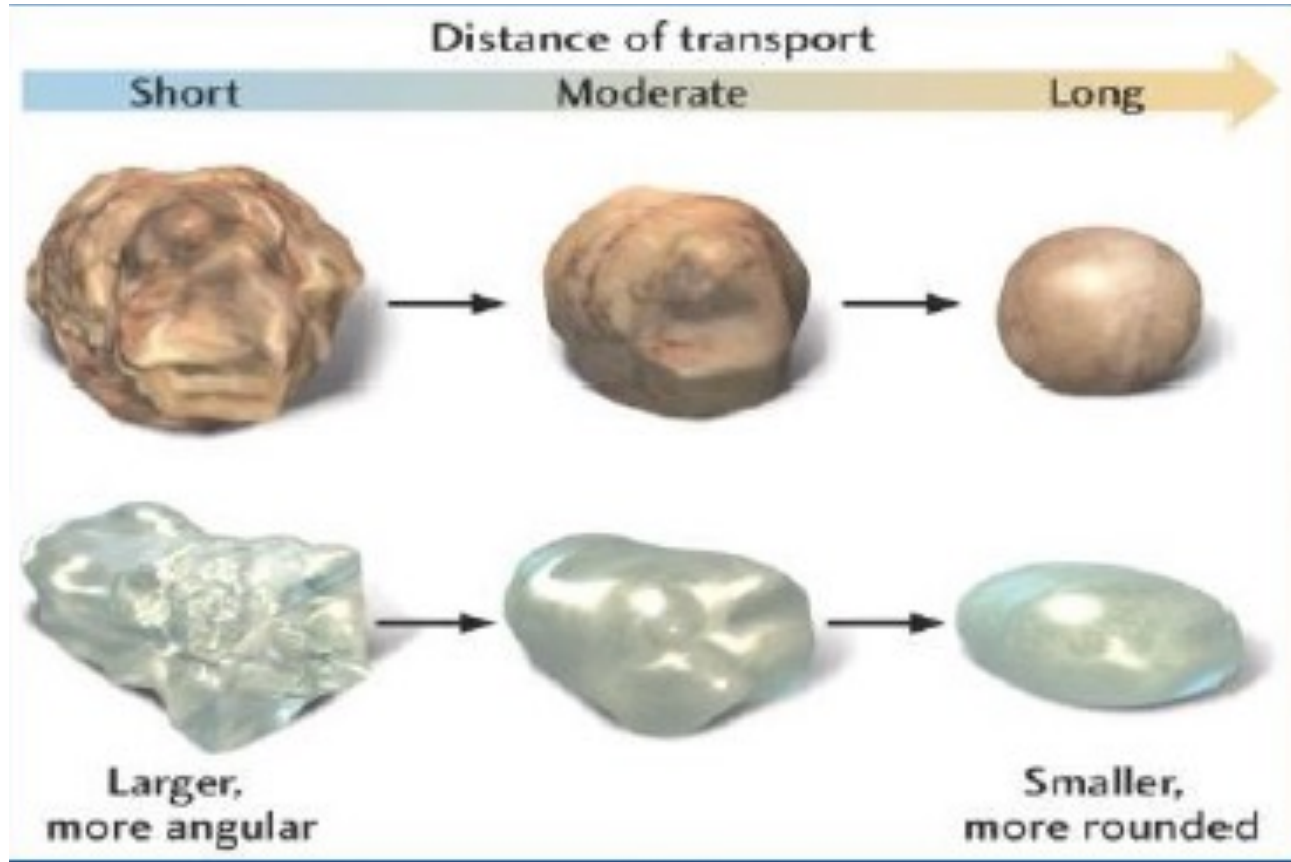
Particle sorting:
what is the relative size of particles

Rapid deposition could result in poor sorting



Transportation of sediments

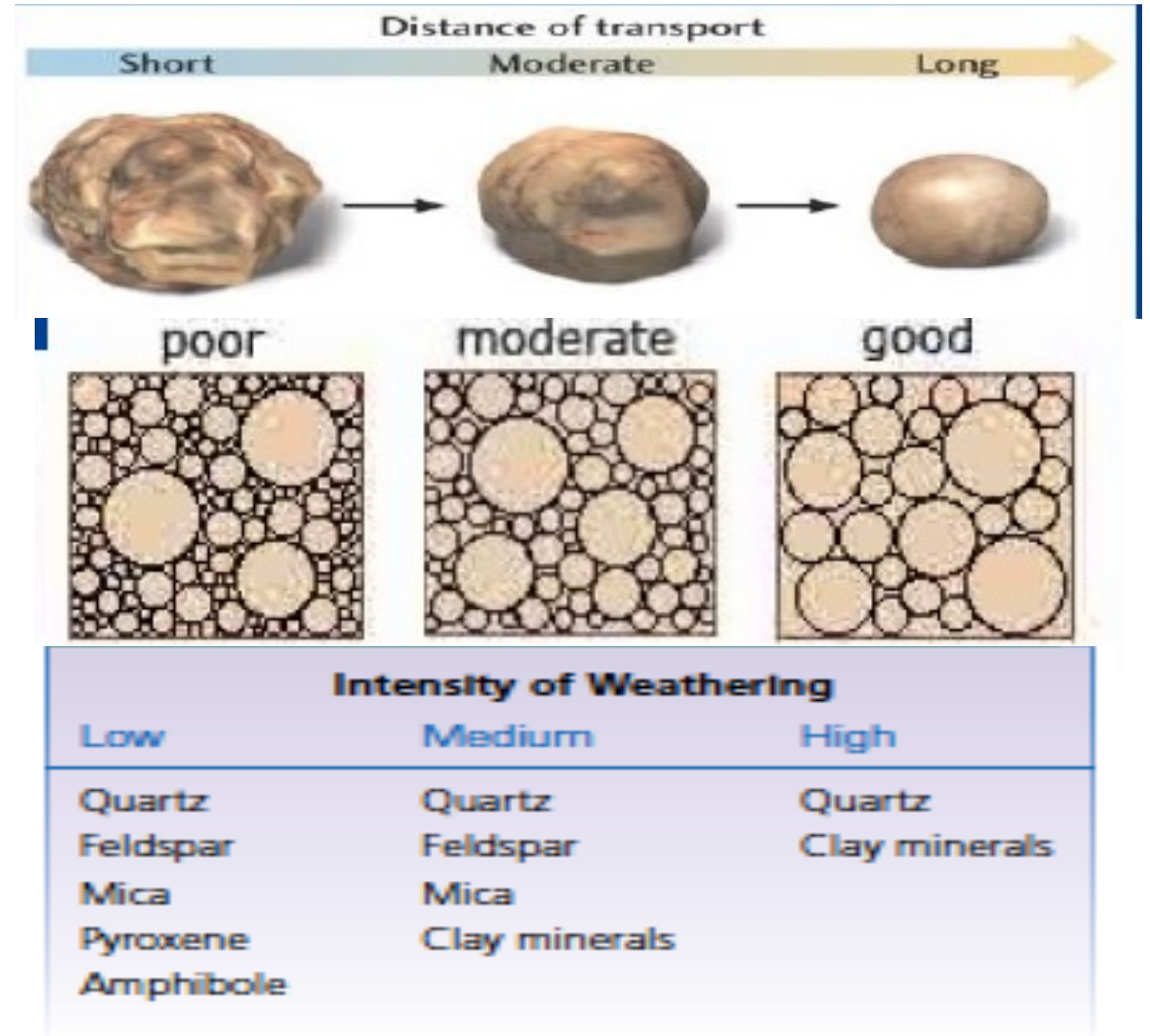
Shape: Rounding



History of
weathering and
erosion?

Transportation of sediments

History weathering and erosion?



Sandstone and Shale: Detrital

Sandstone: Sedimentary rocks made up of sand sized particles

Shale: Sedimentary rocks made up of clay sized particles

Sandstone



Shale



Conglomerate and Breccia: Detrital



A conglomerate has rounded clasts while a breccia has angular clasts. Since water transport (high energy) rapidly rounds large clasts, breccias normally indicate minimal transport.

Evaporite: Chemical

Common minerals: Halite, Gypsum - Result of prolonged evaporation.

Coal: Biological

Often contains leaves, bark and wood fragments.

Types: Peat, Lignite, Bituminous, Anthracite

Limestone: Biological-Chemical

Majority of the limestone has biochemical origin

It could be generated by inorganic processes (example: dripstone in caves)