

# **Rocks with Courtney & Lucia!!**



**Presented by:**  
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# Activity Resources

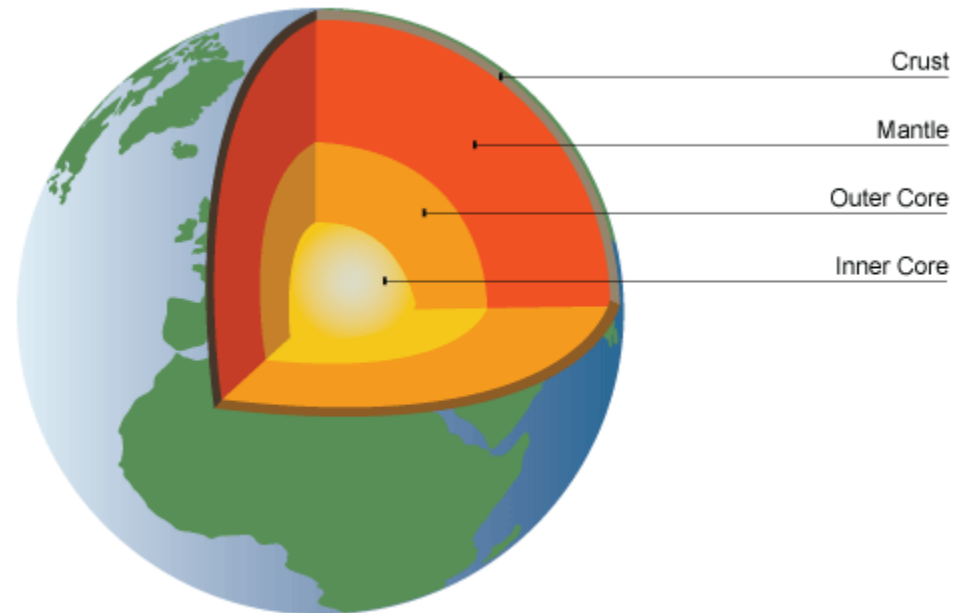
- **The Mining Association Website:**  
[http://www.nevadamining.org/issues\\_policy/activities.php](http://www.nevadamining.org/issues_policy/activities.php)
  - Mineral Detective
  - Sedimentary Successions in a Cup
  - Birdseed Mining
  - And More!
- **Women in Mining Website:**  
<http://www.womeninmining.org/activities/>
  - Edible Igneous
  - Walnut Geodes
  - Stake a Claim
  - And More!

# What are the 3 Main Rock Types?

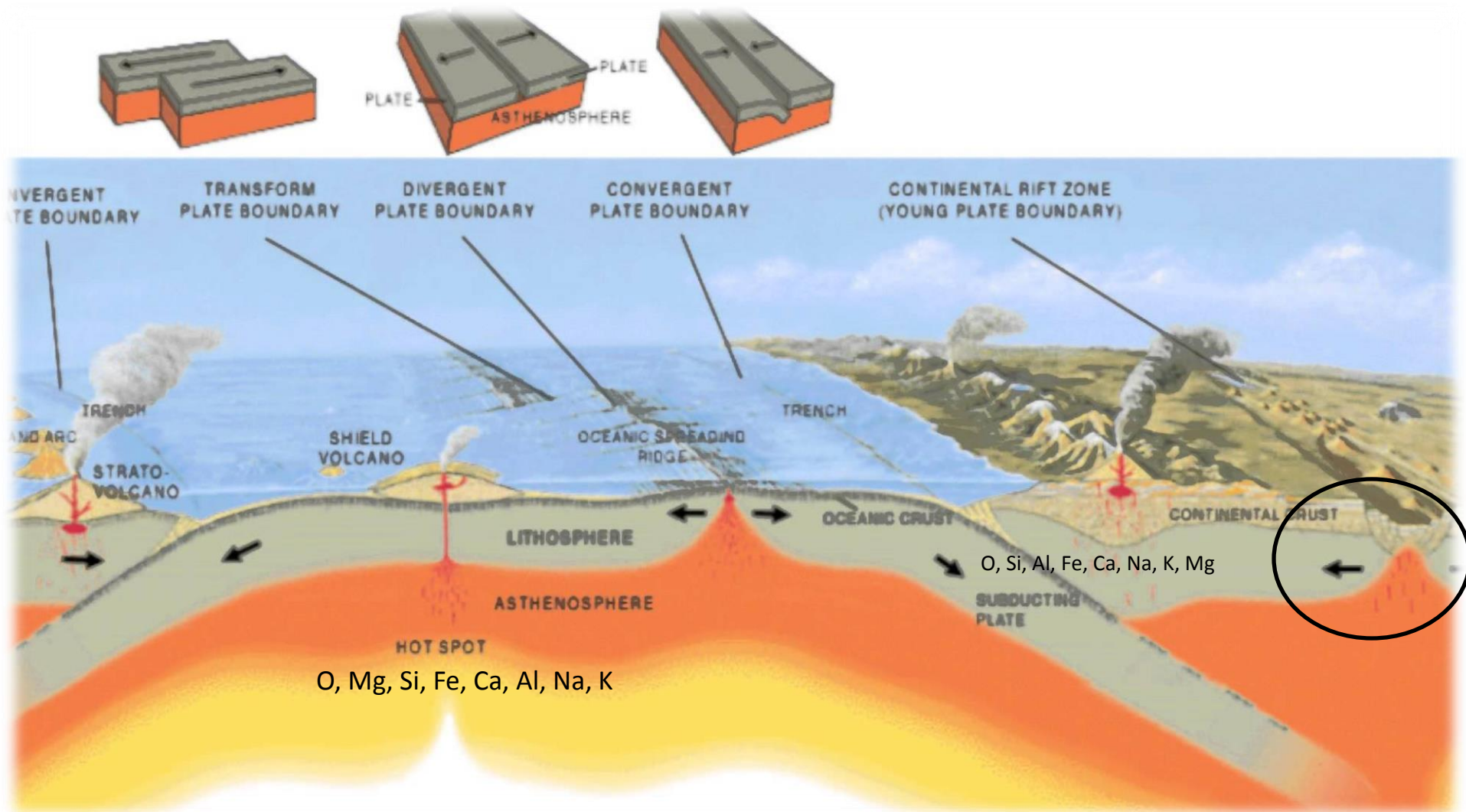
- **Igneous (from fire):** are rocks formed from bodies of hot liquid rock (magma)
- **Sedimentary:** rocks that are formed by the deposition of material or sediment at the earth's surface
- **Metamorphic (a change in form):** any bedrock subjected to greatly increased pressures or very high temperatures, or both, which changes its physical and chemical properties

# Mantle vs Crust

- ▣ Crust – outermost solid shell of a rocky planet
- ▣ There are 2 types of crust:
  1. Dense oceanic crust 3-6mi thick composed of basalt diabase and gabbro
  2. Continental crust 20-30 mi thick composed of less dense rocks such as granite
- ▣ Both types of crust float on the mantle
- ▣ The mantle is compositionally mafic
- ▣ The crust is dominantly felsic



# Igneous Rocks Review





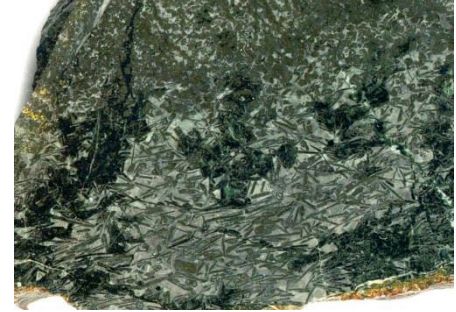




Mafic

Felsic

Intrusive (Coarse Grained)	Extrusive (Fine Grained)
Peridotite	Komatiite
Gabbro	Basalt
Diorite	Andesite
Granite	Rhyolite





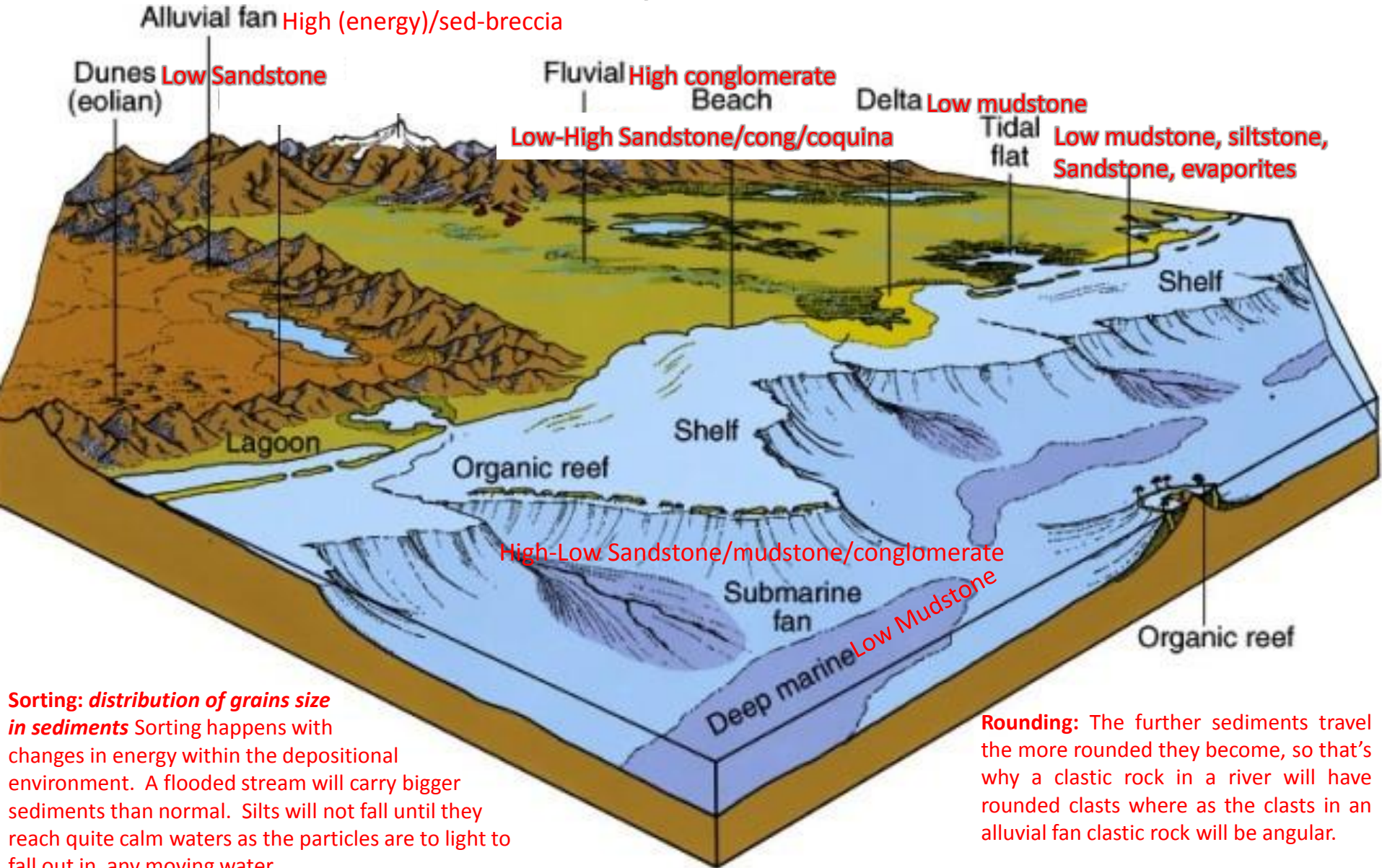
← Increasing Crustal Contamination (the lava incorporated crust as it rose)

		Granitic (Felsic)	Andesitic (intermediate)	Basaltic (mafic)	Ultramafic
Dominant Minerals		Quartz & Potassium feldspar	Amphibole & Intermediate plagioclase feldspar	Pyroxene & Calcium-rich plagioclase feldspar	Olivine & Pyroxene
Color		Light-Colored Less than 15% dark minerals	Medium-colored 15-40% dark minerals	Dark gray to black More than 40% dark minerals	Dark-green to black Nearly 100% dark minerals
Texture	Coarse-grained	Granite	Diorite	Gabbro	Peridotite
	Fine-grained	Rhyolite	Andesite	Basalt	Komatiite
	Porphyritic	Porphyry follows any of the above names whenever there are appreciable phenocrysts			
	Glassy	Obsidian (compact glass) Pumice (frothy glass)			

↑ Increasing Cooling Time



# Sedimentary Rocks Review



**Sorting: distribution of grains size in sediments** Sorting happens with changes in energy within the depositional environment. A flooded stream will carry bigger sediments than normal. Silts will not fall until they reach quite calm waters as the particles are too light to fall out in any moving water.

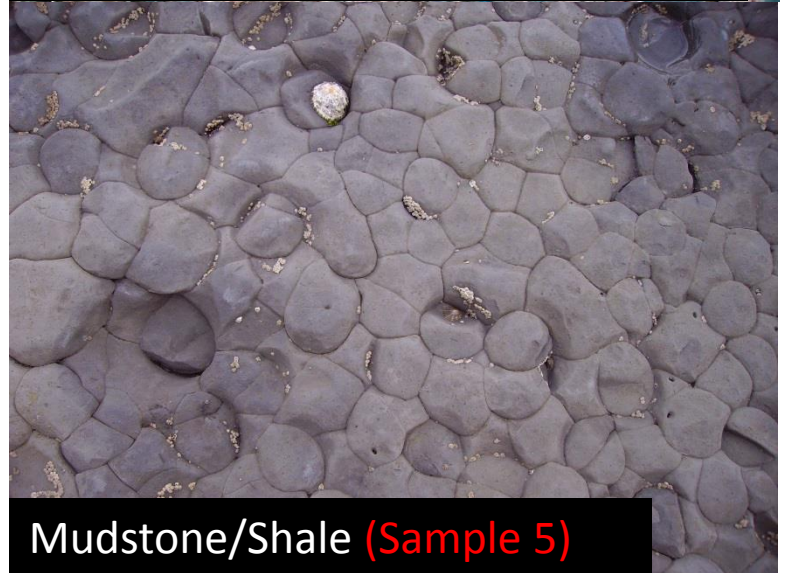
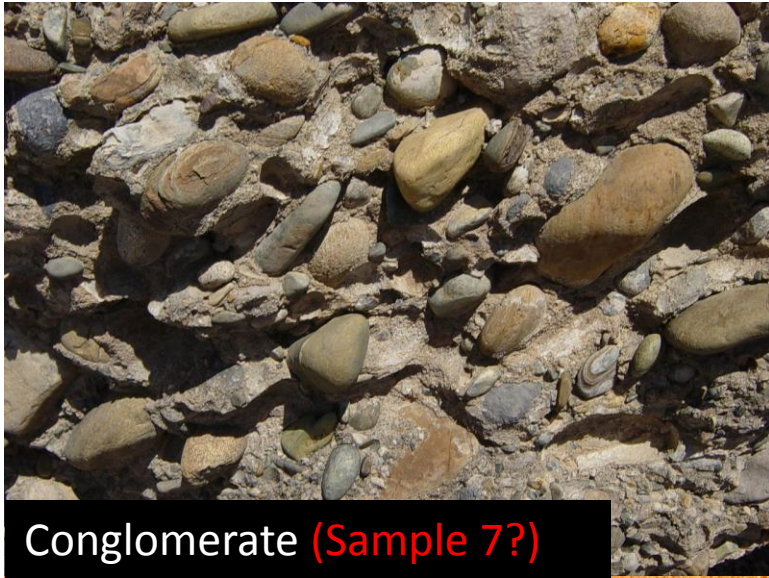
**Rounding:** The further sediments travel the more rounded they become, so that's why a clastic rock in a river will have rounded clasts whereas the clasts in an alluvial fan clastic rock will be angular.

High Energy = Larger sediments Low Energy = Smaller sediments



# Clastic

Composed of silicate minerals and rock fragments (conglomerates, sedimentary breccias, sandstones, and mudstones)



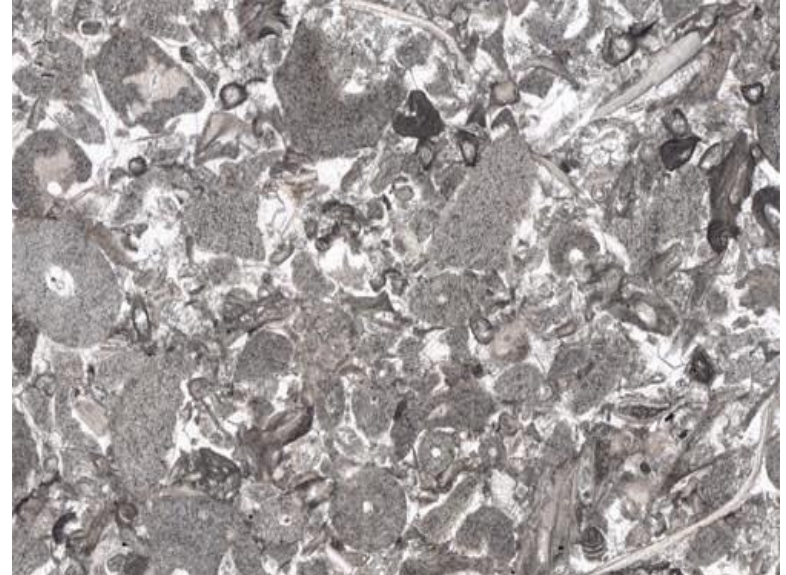


# Bioclastic

Composed of skeletal fragments of marine or land organisms



Coquina





# Biochemical

Rocks Created when organisms use materials dissolved in air or water to build their tissue (**limestone Sample 8**, coal, & **chert**) then the fragments or debris of the dead organisms accumulate and are lithified (transformed into stone)



Differs from Coquina because this rock is cemented where Coquina has little to no cement



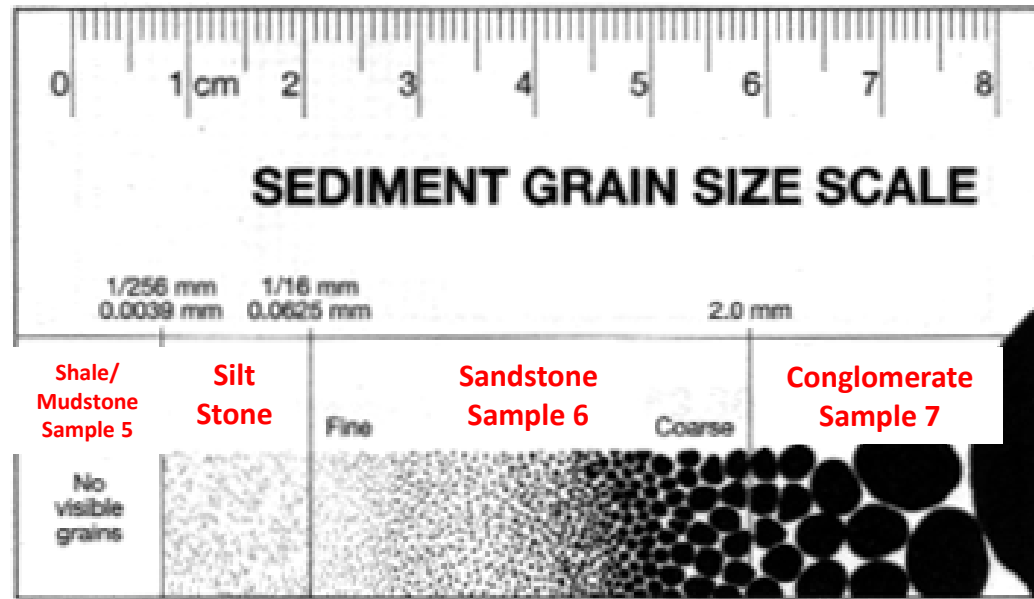


# Chemical

Form when mineral constituents in a solution become supersaturated and inorganically precipitate (**limestone**, dolomite, **chert**, halite, sylvite, barite, & gypsum)



# Texture: Grain Size-Sedimentary Rocks



Increasing energy in depositional environment



*Rounding of grains/clasts = degree of sediment transport*

Again, Understanding what texture is telling you about the environmental factors present during rock formation can help with rock identification

# Composition

- ▣ Mineral composition:
  - Calcite/dolomite = chemical/biochemical
  - Silica = chemical/biochemical
  - Halite/Salt = Evaporite
- ▣ Fossils? Fossils won't be in a volcanic rock
- ▣ Reaction to acid = calcite = limestone
- ▣ Reaction to acid when scratched = dolomite
- ▣ Light color = shallow water deposits
- ▣ Sorting? Sedimentary rocks exhibit sorting (*distribution of grain size in sediments*) where other rock types do not



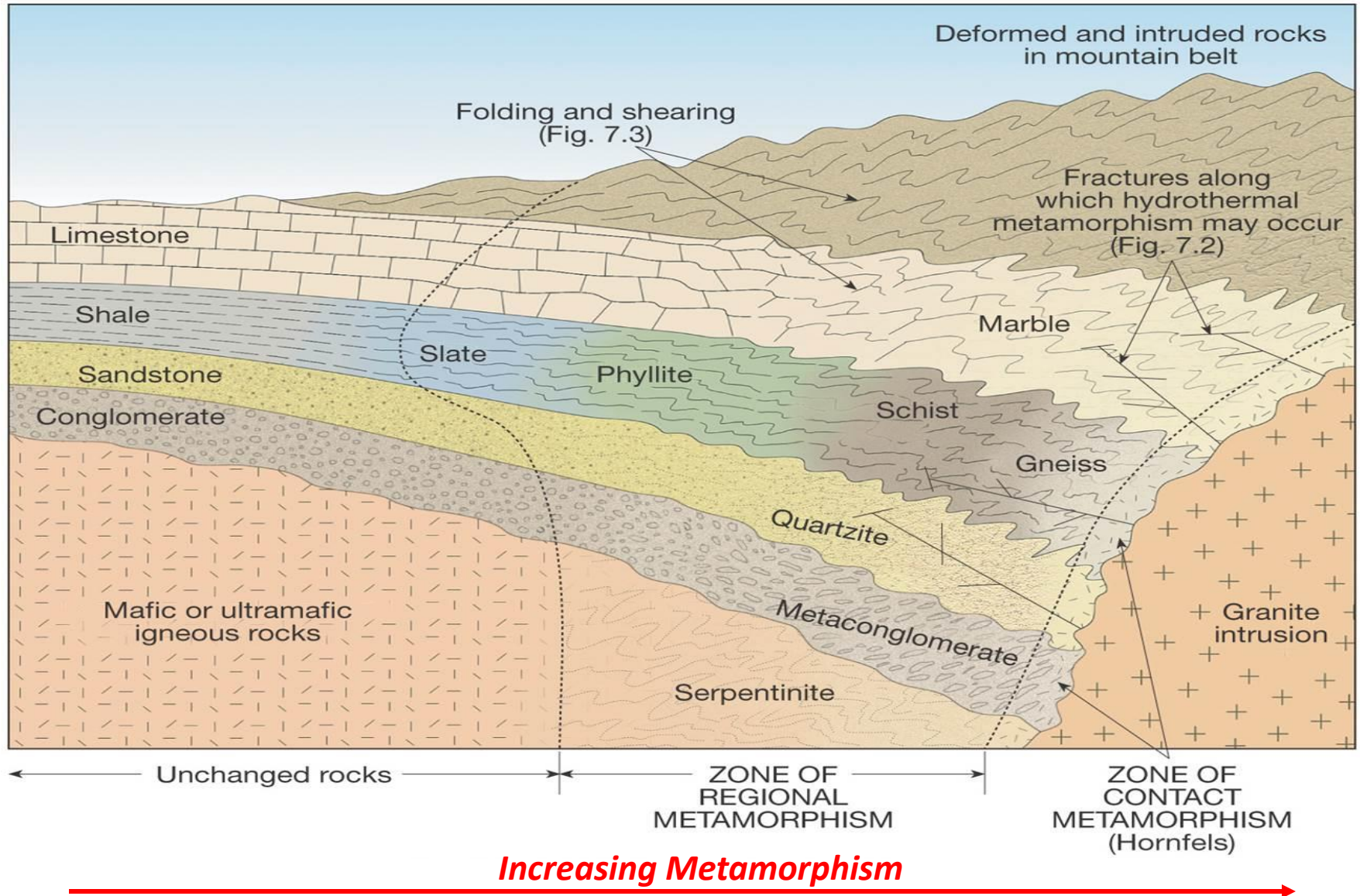


# Sedimentary Rock Classification

Clastic & Bioclastic textures								
Texture	Size		Clast Composition	Rounding	Sorting	Rock Name	Comments	Depositional Environment
Clastic	>2 mm	gravel	variable	angular	poor	sedimentary breccia	large angular clasts - less transport	alluvial fan
	>2 mm	gravel	variable	rounded	poor	conglomerate	large rounded clasts - more transport	alluvial fan, stream, beach
	2-1/16 mm	sand	quartz	rounded	well	quartz sandstone	"clean" sandstone - more transport	dunes, stream
	2-1/16 mm	sand	feldspar, quartz, etc.	angular	mod-poor	arkose	"dirty" sandstone - less transport	alluvial fan, stream
	<1/16 mm	mud	-	-	well	mudstone	may split apart along bedding; may or may not "fizz"; easily scratched	floodplain, delta, shallow & deep marine
Bioclastic	>2 mm	gravel	shells	poor	poor	coquina	poorly-cemented shell fragments	beach
	<1/16 mm	mud	shells	-	well	chalk	microscopic shells; "earthy"	shallow-deep marine
Chemical & Biochemical textures								
Texture	Composition		Hardness	Color		Rock Name	Comments	Depositional Environment
Chemical	calcite / CaCO <sub>3</sub>		H=3	variable		limestone	will "fizz"; can be scratched by a nail	shallow marine, lake
	dolomite / CaMg(CO <sub>3</sub> ) <sub>2</sub>		H=3	variable		dolomite	will <u>not</u> "fizz" unless scratched; can be scratched by a nail	nearshore marine
	silica / SiO <sub>2</sub>		H=7	variable		chert	will <u>not</u> "fizz"; <u>not</u> scratched by a nail	deep sea
	halite / NaCl gypsum / CaSO <sub>4</sub> *2H <sub>2</sub> O		H=2.5 H=2	clear-variable white-variable		evaporites	soft, non-metallic minerals; halite is "salty"	playa
Bio	altered organic remains		soft	brown-black		coal	light in weight	swamp



# Metamorphic Rocks Review

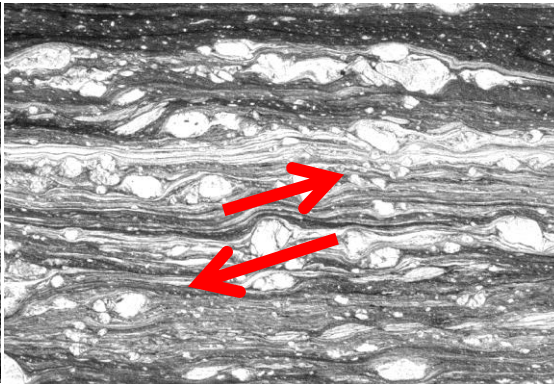
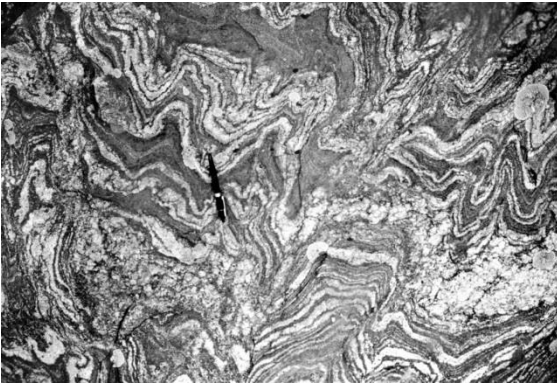


# Metamorphic Rocks

*Any bedrock subjected to greatly increased pressures or very high temperatures, or both, which changes its physical and chemical properties*

There are 2 main groups of metamorphic rocks

1. Foliated (**Samples 9 & 10**) – a planar element expressed by closely spaced fractures, parallel arrangement of platy minerals or alternating layers of different mineral composition





2. Non-Foliated (**Sample 12**) – massive structureless metamorphic rocks with elongated grains or other linear features resulting from directional stress





# Texture: Grain Size/Foliation- Metamorphic Rocks

Increasing P & T 

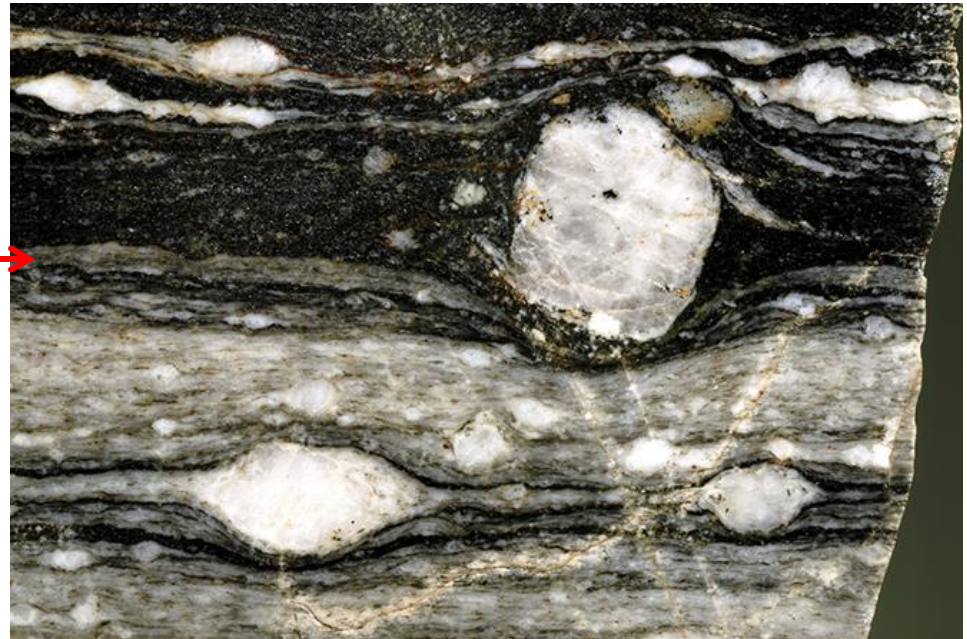


	Grain Size		
	Fine	Medium	Coarse
Poorly Foliated	Hornfels	Marble, Quartzite	Marble, Quartzite
Well Foliated	Slate	Schist	Gneiss
Well Foliated & Sheered	Mylonite	Mylonite, Schist	Augen Gneiss

Again, understanding what texture is telling you about the environmental factors present during rock formation can help with rock identification

# Composition

- ▣ Mineral composition:
  - Quartz, muscovite, illite = slate
  - Mica, Quartz, Garnet = schist
  - Feldspar, Quartz = gneiss
- ▣ Reaction to acid = calcite = marble
- ▣ Elongated grains or other linear features resulting from directional stress





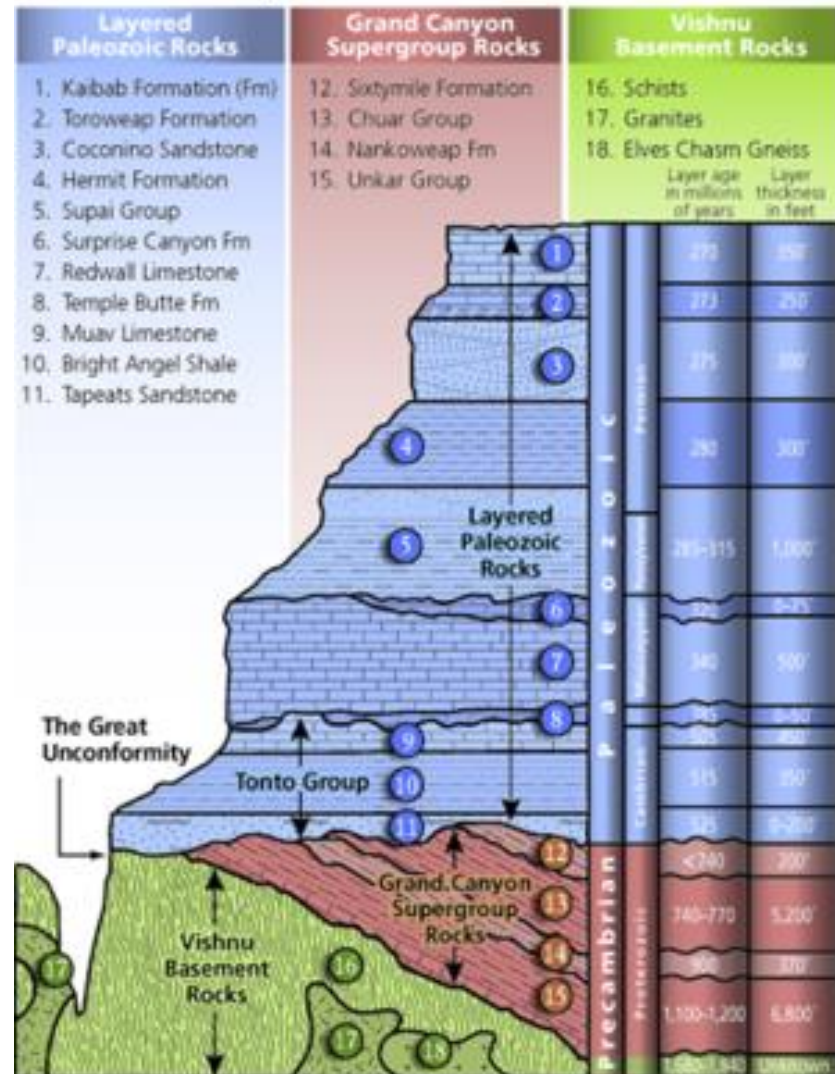
Rock Name		Texture	Grain Size	Comments	Parent Rock
Slate	Increasing Metamorphism ↓	Foliated	Very fine	Excellent rock cleavage, smooth dull surfaces	Shale, mudstone, or siltstone
Phyllite			Fine	Breaks along wavy surfaces, glossy sheen	Slate
Schist			Medium to Coarse	Micas dominate, scaly foliation	Phyllite
Gneiss			Medium to Coarse	Compositional banding due to segregation of minerals	Schist, granite, or volcanic rocks
Marble		Nonfoliated	Medium to coarse	Interlocking calcite or dolomite grains	Limestone, dolostone
Quartzite			Medium to coarse	Fused quartz grains, massive, very hard	Quartz sandstone
Anthracite			Fine	Shiny black organic rock that may exhibit conchoidal fracture	Bituminous coal

# Stratigraphy

Stratigraphy is the branch of geology concerned with all characters and attributes of rocks as strata (layers); and their interpretation in terms of mode of origin and geologic history.

- Basis for stratigraphy
  - Law of superposition
  - Principle of original horizontality
  - Principle of lateral continuity
- With these rules we can construct a stratigraphic column
  - A representation used in geology and its subfield of stratigraphy to describe the vertical location of rock units in and area and show the sequence of rocks with the oldest rocks on the bottom and the youngest rocks on top.

**Grand Canyon's Three Sets of Rocks**



# Exercise

- As with minerals certain rock types are associated with other rock types in specific environments
- Textural clues in the rock tell you about the environment of deposition
- The stratigraphic sequence can tell a story about what was happening in that particular environment millions of years ago
- Please pick a suite of rocks and answer the questions associated with them. For each suite of rocks the end objective is to:
  - Hypothesize as to what caused this rock sequence to develop the way it did and give a narrative description of the depositional environment to create a mental visualization for others