

Rocks (All Types) Summary Notes / Slides

Chapter 5

Rocks

1

What is a rock?

Def. A rock is a group of minerals joined together in some way.

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A **rock** is a hard material made of one or more minerals

Or anything that when you pick it up and throw it at someone it produces the reaction:
"Owww! Why did you hit me in the head with a rock?"

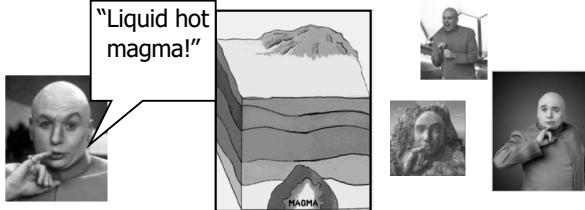
The dictionary is no use here:
Rock *n.* a large mass of stone; a concretion of stony material; consolidated mineral matter
 I love this one: **something like a rock in firmness**

By the way, a *stone* is " a piece of rock!"
 A rock can be made of only one mineral entirely (**monomineralic**) or a mixture of many minerals (**polymineralic**)

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Igneous rocks form from the cooling or SOLIDIFICATION of "liquid hot" magma or lava (melted rock).

The RECRYSTALLIZATION of minerals is evident in Igneous Rocks.



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LIQUID HOT MAGMA

- *Magma* is a mixture of liquid rock, crystals, and gas
- It is characterized by a wide range of chemical compositions, with high temperature, and properties of a liquid
- Magmas are less dense than surrounding rocks, and will therefore move upward

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- If magma makes it to the surface it will erupt (now it's called lava) and later crystallize to form an *extrusive* or *volcanic rock*
- If it crystallizes before it reaches the surface it will form an igneous rock at depth called a *plutonic* or *intrusive igneous rock*
- Because cooling of the magma takes place at different rates, the crystals that form and their texture (size) exhibit different properties

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There are 2 Main Types of Igneous Rocks

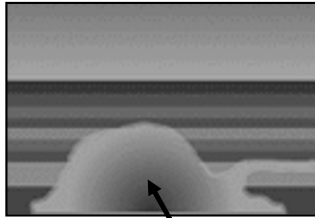
1. Intrusive
2. Extrusive

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Intrusive Igneous Rocks

- Formed by the SLOW cooling of magma **UNDERGROUND**
 - "in"-trusive
 - "in"-side the ground
 - aka - PLUTONIC

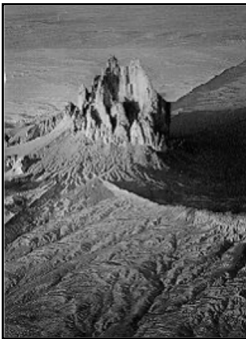
Intrusive = Plutonic
Plutonic = Intrusive



THEY ARE THE SAME THING!!!

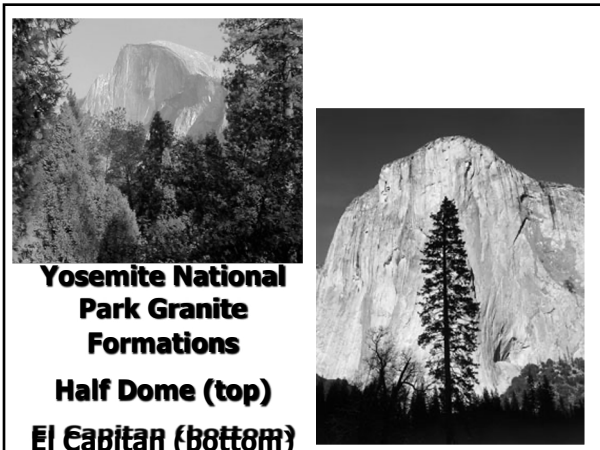
See...magma underground

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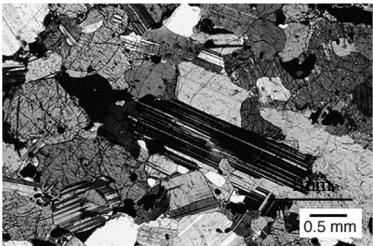
Shiprock, NM
An intrusive igneous rock formation that has been exposed by weathering and erosion

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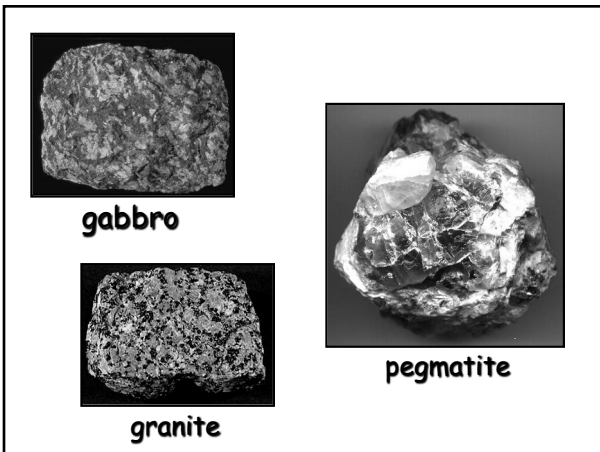
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- **Underground cooling is SLOWER so the minerals have time to come together to form large intergrown mineral crystals.**
 - **Intrusive Rock crystals are LARGE & have a coarse texture (size)**

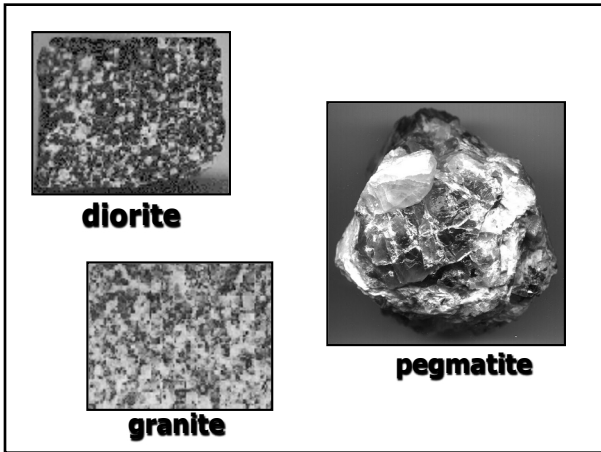


To give you an idea of the scale... a dime is about 1 mm thick. So, these crystals can all be seen with the naked eye and are "chunky".

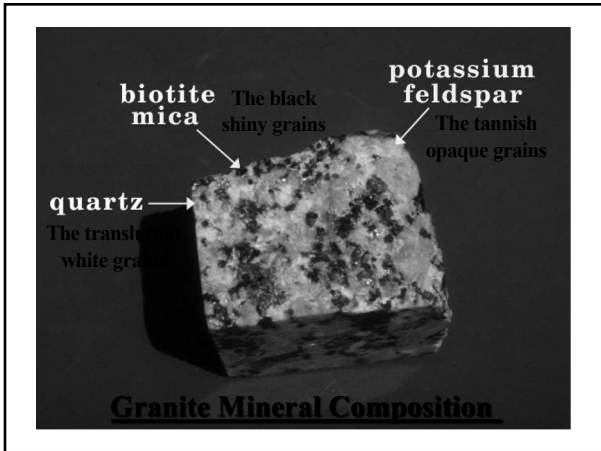
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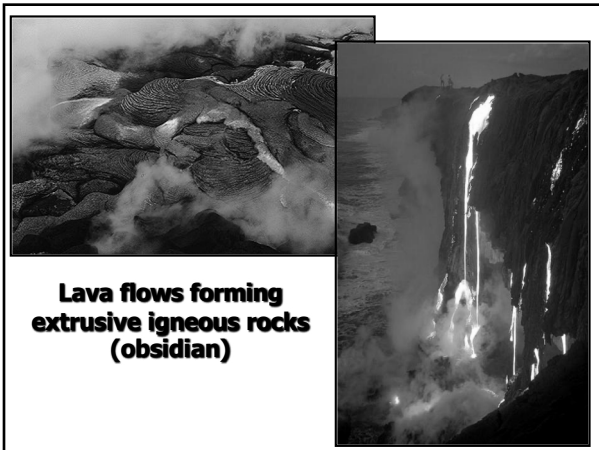
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Extrusive Igneous Rocks

- Formed from the cooling of **LAVA** (magma that has reached earth's surface)
- Extrusive = Volcanic
- Volcanic = Extrusive

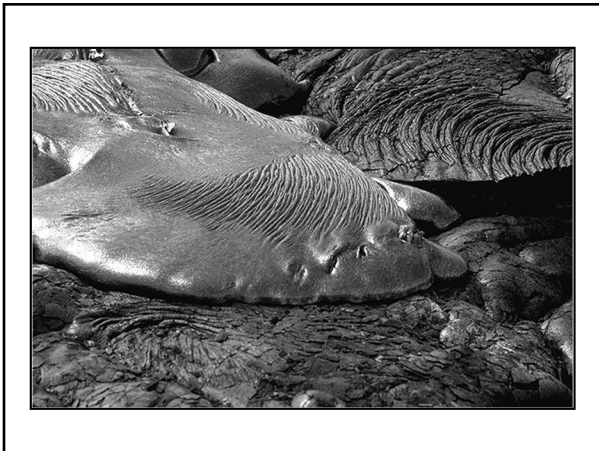
THEY ARE THE SAME THING!!

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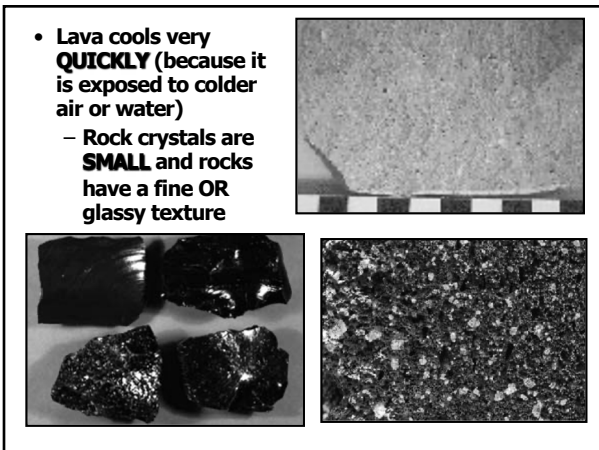


**Lava flows forming
extrusive igneous rocks
(obsidian)**

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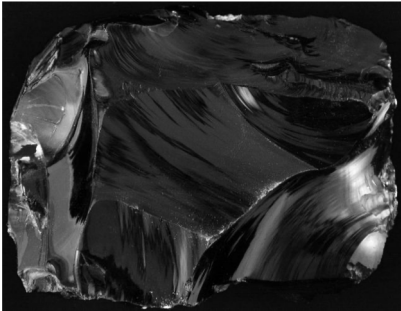


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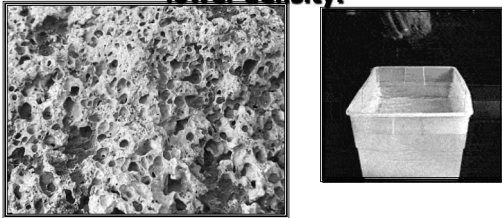
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- Obsidian has a glassy texture – it cools so quickly that crystals don't even have time to form. Note the conchoidal fracture!!

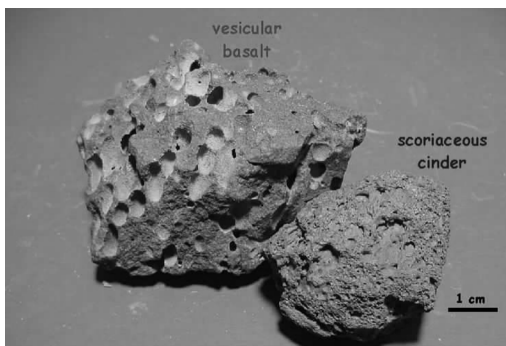


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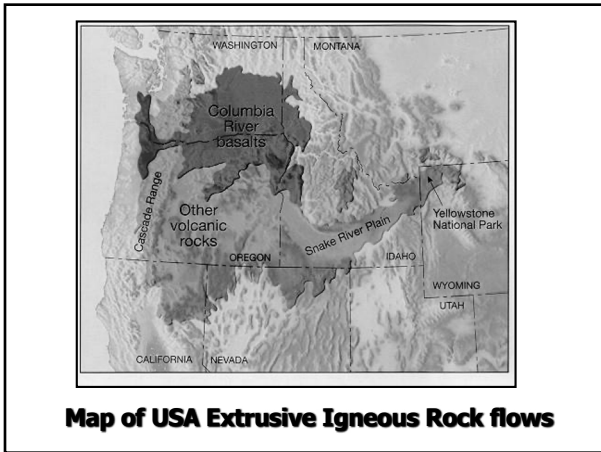
Pumice is an Extrusive Igneous Rock that is VESICULAR (has gas pockets). Because pumice formed so quickly, the lava solidified around the pockets of gas, creating "holes" in the rock. This allows the rock to float in water because of its lower density!



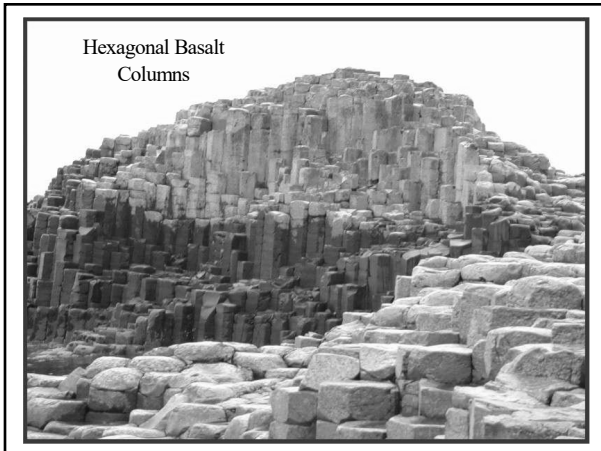
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Key Idea: 

The texture of the igneous rock is determined by the size, shape, and arrangement of the *mineral crystals!*

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Types of Magma (and therefore types of igneous rocks) (chart)

- **FELSIC MAGMA**
 - Light colored
 - Thick (high viscosity)
 - Contains high amounts of silica
 - Example ⇒ Granite
- **MAFIC MAGMA**
 - Dark colored
 - Thin (low viscosity)
 - Contains high amount of magnesium & iron
 - Example ⇒ Basalt

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The "bells & whistles" for Identifying an IGNEOUS Rock



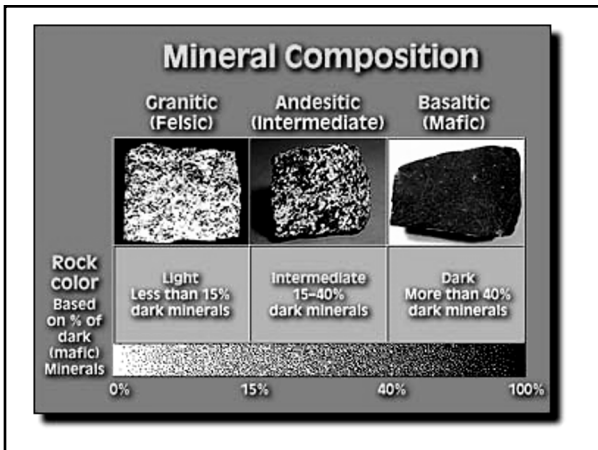
Igneous rocks have



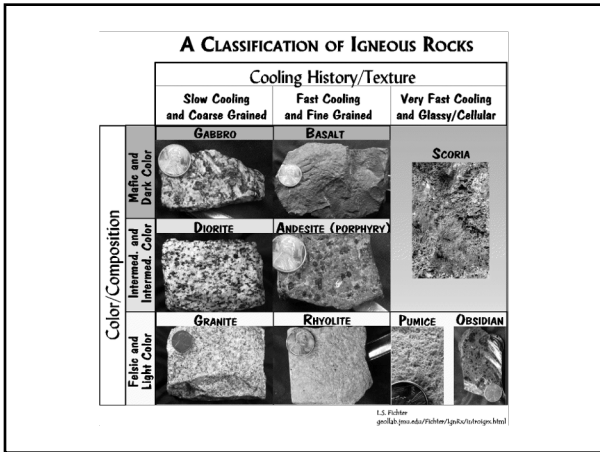
INTERGROWN CRYSTALS!!!

So, if you see intergrown mineral crystals, it's probably igneous!

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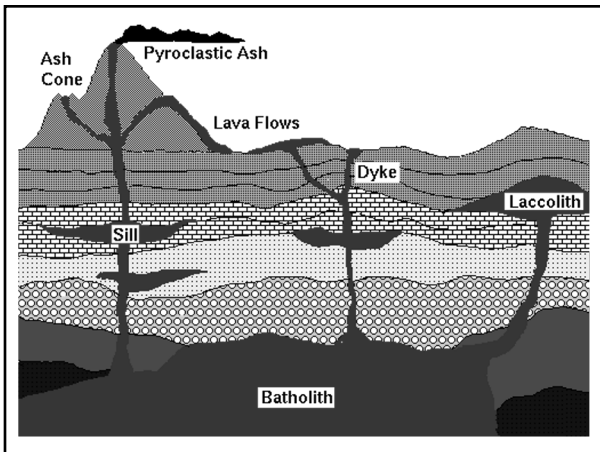


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Igneous Rock Formations

- **Intrusive Magma flows** can solidify and form great areas of intrusive igneous rocks.
- **Dike** – a vertical “wall” of igneous rock that cuts across rock layers (think a dam is also called a dike)
- **Sill** – a horizontal sheet of intrusive igneous rock forced between rock layers parallel to the rock layers it intrudes upon (think window sill = horizontal)
- **Laccolith** – A dome shaped mass of intrusive igneous rock.
- **Batholith** – the largest of all igneous intrusions – form the cores of many mountain ranges. (ex Half-dome and El Capitan in Yosemite)

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Sedimentary Rocks

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INORGANIC LAND-DERIVED SEDIMENTARY ROCKS					
TEXTURE	GRAIN SIZE	COMPOSITION	COMMENTS	ROCK NAME	MAP SYMBOL
Clastic (fragmental)	Pebbles, cobbles, and/or boulders embedded in sand, silt, and/or clay	Mostly quartz, feldspar, and clay minerals; may contain fragments of other rocks and minerals	Rounded fragments	Conglomerate	
			Angular fragments	Breccia	
	Sand (0.2 to 0.006 cm)		Fine to coarse	Sandstone	
	Silt (0.006 to 0.0004 cm)		Very fine grain	Siltstone	
Clay (less than 0.0004 cm)		Compact; may split easily	Shale		
CHEMICALLY AND/OR ORGANICALLY FORMED SEDIMENTARY ROCKS					
TEXTURE	GRAIN SIZE	COMPOSITION	COMMENTS	ROCK NAME	MAP SYMBOL
Crystalline	Varied	Halite	Crystals from chemical precipitates and evaporites	Rock Salt	
	Varied	Gypsum		Rock Gypsum	
	Varied	Dolomite		Dolostone	
Bioclastic	Microscopic to coarse	Calcite	Dispersed shell fragments or precipitates of biologic origin	Limestone	
	Varied	Carbon	From plant remains	Coal	

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3 Types of Sedimentary Rocks

- **CLASTIC** – formed from fragments (clasts) of other land-based rocks
 - Sandstone, Shale, Conglomerate
- **CHEMICAL/EVAPORITES/PRECIPITATES/CRYSTALLINE** – formed from the mineral precipitates of evaporated seawater
 - Rock Salt, Gypsum, Dolostone, Chemical Limestone, Chert
- **ORGANIC** – formed from the remains of plants & animals
 - Coal, Fossiliferous Limestone

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Type 1 - CLASTIC

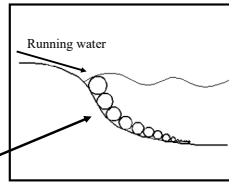
- Formed when rock fragments & sediments (clasts) are carried & deposited by **WIND, GLACIERS, & RUNNING WATER**
- Sediments are **DEPOSITED**, then **COMPACTED & finally CEMENTED** together to form rock



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Most sediment is carried by Running Water!

- The further water carries the sediment, the more **ROUNDED & SMOOTHER** the particle becomes
- When a stream slows down, it drops the **LARGEST** particles first, & the **SMALLEST** particles last (**HORIZONTAL SORTING**)



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Breccia – very large sediments that are angular (note hammer for size reference)

Conglomerate
– large sediments that are rounded (have been transported by a stream!)

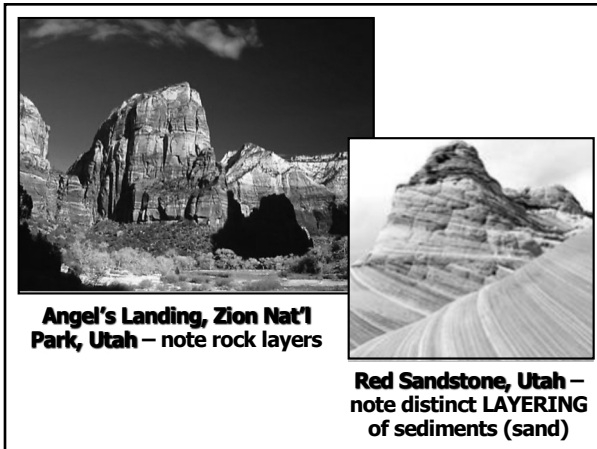


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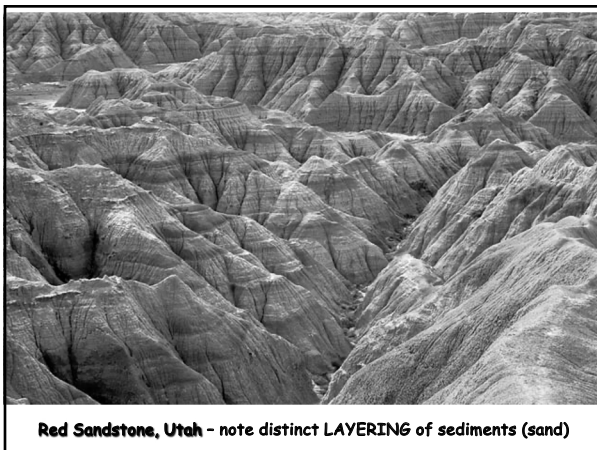
STRATIFICATION

- Sandstones & Siltstones form from smaller sediments that tend to create "layers" of sediments in rocks
- This is known as **STRATIFICATION** (layering)
- There will be layers of **SIMILAR** colored minerals

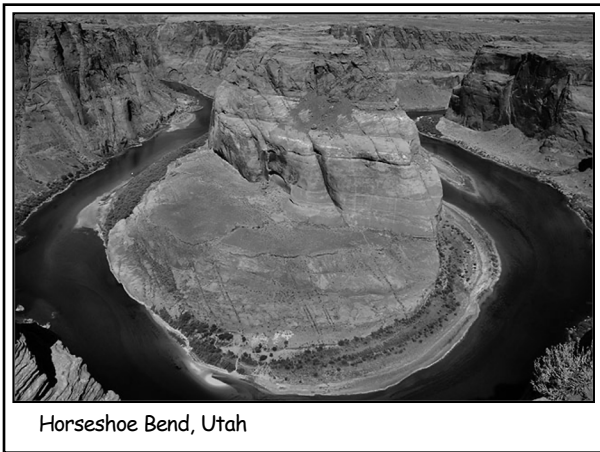
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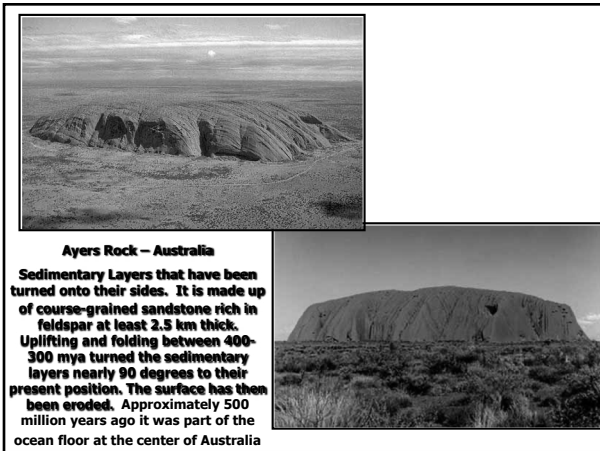
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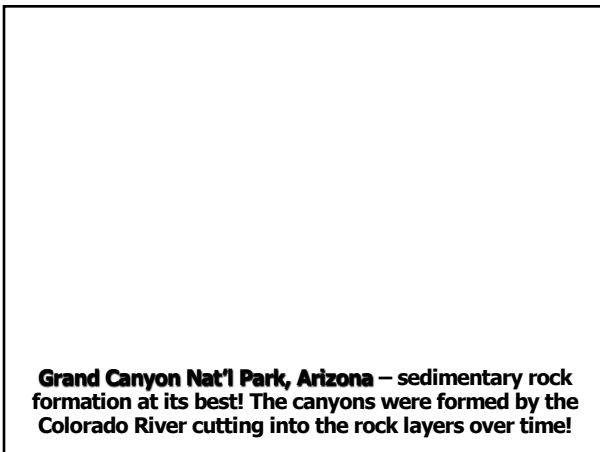
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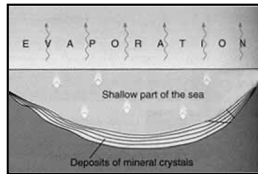
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2. CHEMICAL

- Formed when dissolved minerals in seawater are **PRECIPITATED OUT** (seawater **evaporates**, leaving the minerals behind)
 - Limestone, Halite, Gypsum (used to make sheetrock)



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Salt "Mines" - Rock Salt (Halite) is being formed as the water evaporates from the sea.

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"Devil's Golf Course" – millions of years ago this was a sea of salt water. It has been evaporating over time...



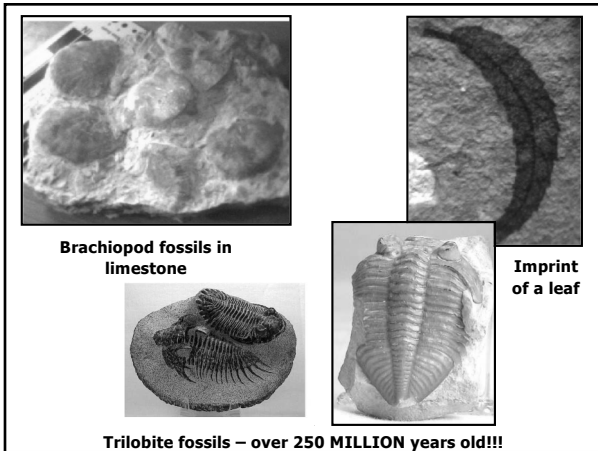
...and has formed "pockets" of chemical limestone, rock salt, and rock gypsum!

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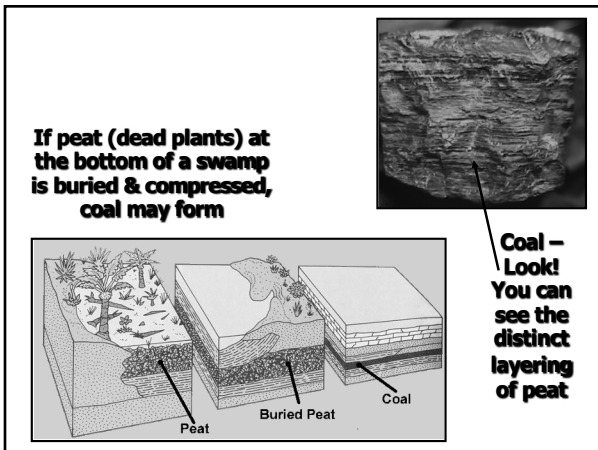
3. ORGANIC

- Formed from the remains of plants & animals that are compacted
 - **Fossil Limestone** – formed when shell remains of marine organisms are cemented in fragments
 - Shells are made of *CALCITE* which reacts with acid and is a natural "cement"

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Bells & Whistles for Sedimentary Rock Identification!



- **Stratification** – “layering” of sediments
- **Fossils** – actual remains or imprints
- **Ripple marks, mud cracks, etc...**












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Metamorphic Rocks

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Scheme for Metamorphic Rock Identification

TEXTURE	GRAIN SIZE	COMPOSITION	TYPE OF METAMORPHISM	COMMENTS	ROCK NAME	MAP SYMBOL
FOLIATED MINERAL ALIGNMENT	Fine	MICA QUARTZ FELDSPAR CLAY GARNET PYROXENE	Regional (Heat and pressure increases)	Low-grade metamorphism of shale	Slate	
	Fine to medium			Foliation surfaces shiny from microscopic mica crystals	Phyllite	
	Medium to coarse			Platy mica crystals visible from metamorphism of clay or feldspars	Schist	
	Medium to coarse			High-grade metamorphism; mineral type segregated into bands	Gneiss	
NONFOLIATED	Fine	Carbon	Regional	Metamorphism of bituminous coal	Anthracite coal	
	Fine	Various minerals	Contact (heat)	Various rocks changed by heat from nearby magma/lava	Hornfels	
	Fine to coarse	Quartz	Regional or contact	Metamorphism of quartz sandstone	Quartzite	
	Fine to coarse	Calcite and/or dolomite		Metamorphism of limestone or dolostone	Marble	
	Coarse	Various minerals		Pebbles may be distorted or stretched	Metaconglomerate	

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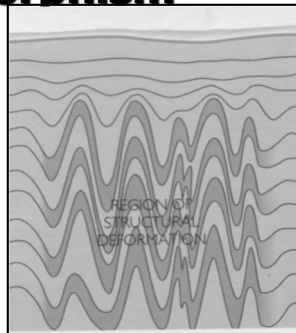
Key Ideas:

- Formed when existing rocks (Igneous, Sedimentary or Metamorphic) are changed by **HEAT AND/OR PRESSURE**
- The new rocks may resemble the "parent" rock in their mineral composition/color
- **IMPORTANT- THE ORIGINAL ROCK CANNOT MELT WHEN IT BECOMES METAMORPHIC!** (If it melts, it's igneous!)

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Types of Metamorphism

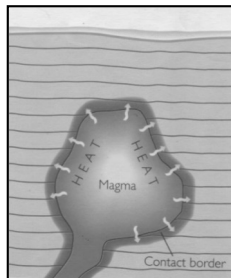
- **REGIONAL**
- Large areas of rock are changed by **HEAT & PRESSURE**



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- **CONTACT**
- "Liquid Hot" Magma touches layers of rock and the **HEAT** causes the rock layers to change
- Note: little to no pressure involved in contact metamorphism.

"Liquid hot magma!"

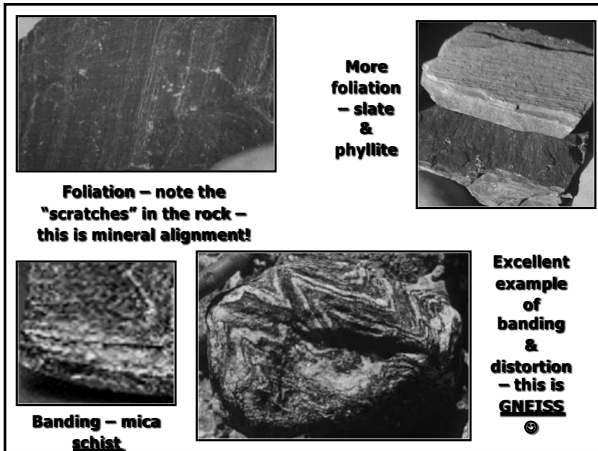


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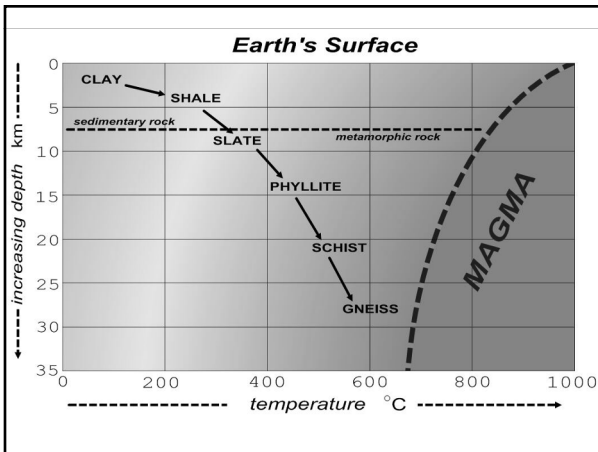
Identifying Characteristics

- **FOLIATION – mineral alignment**– look for “scratches” or lines of minerals in the rocks, which facilitates breakage along flat planes
- **BANDING – alternating layers of different colored minerals**
 - These bands are usually distorted from the heat & pressure

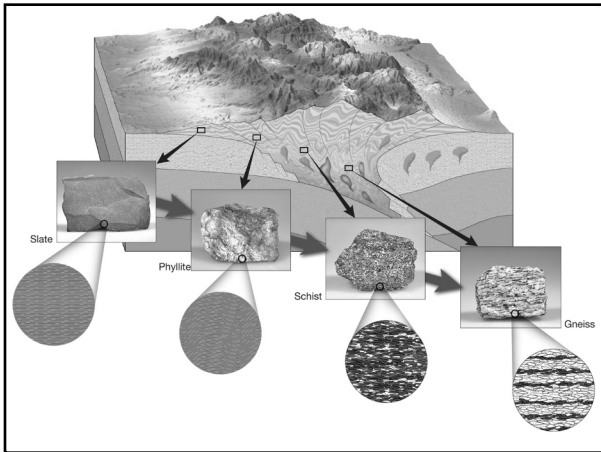
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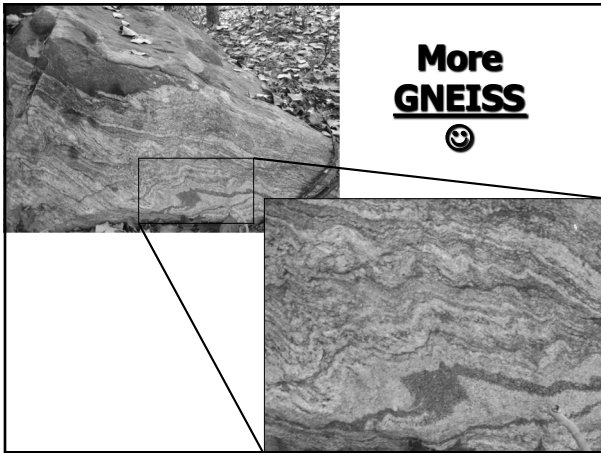
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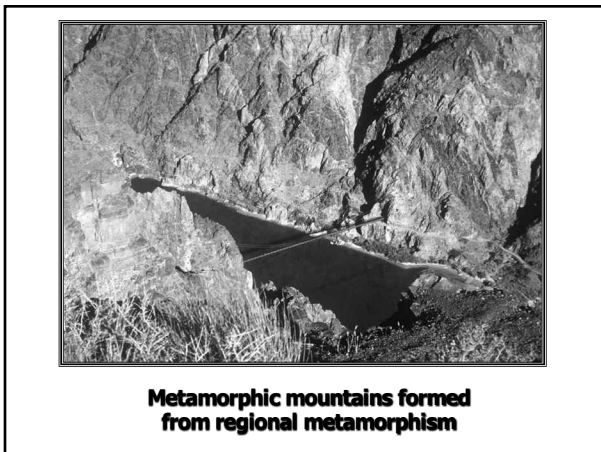
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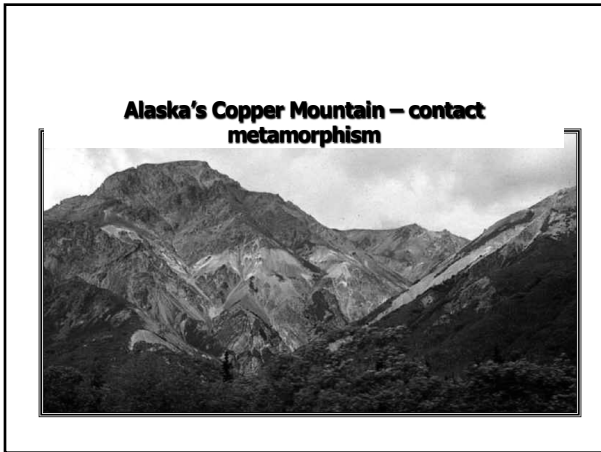
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The Bells & Whistles for Metamorphic Rock Identification

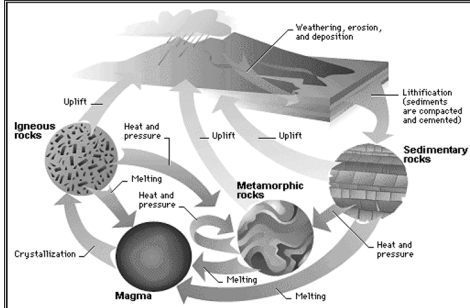
- **FOLIATION** – mineral alignment – look for “scratches” or lines of minerals in the rocks
- **BANDING** – layers of **DIFFERENT COLORS** – not to be confused with sedimentary layers!!!!!! (these will be obviously different parent rock layers)

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<p>When I was young, liquid granite I was diagnosed schizophrenic Neither feldspar, nor mica, nor quartz But the sum of the three Bonded igneously That means melted together for life</p> <p>Well, I was hot and dejected Oh, I was injected Under layers and layers of dirt But, it was there that I changed All my crystals rearranged Into G-N-E-I-S-S, gneiss</p> <p>So, take a look, and you'll see That I'm not what I used to be I've been touched metamorphically All the heat and the pressure Have changed me forever So don't take me for granite, I'm gneiss</p>	<h3 style="margin: 0;">The GNEISS SONG</h3>
	<p>Well, I wasn't to been seen Until time changed the scene Exposing my face to the sun But, now its here that I sit Being worn down bit by bit Oh, erosion is wearing me down</p> <p>Refrain & Musical Break</p> <p>So, be aware, have a look Underground or underfoot For that beautiful pinky-gray face The Canadian shield Holds a magnamous yield Of the rock that was changed into gneiss</p> <p>Refrain</p>

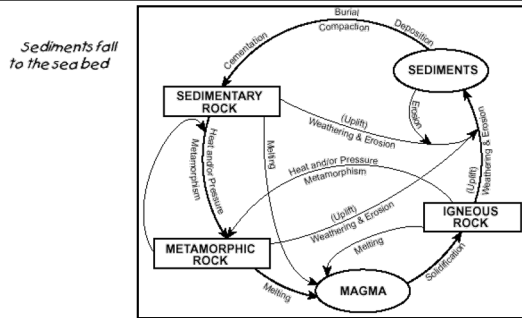
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• The **ROCK CYCLE** shows how each type of rock forms & how each rock can change into a different type of rock!



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The **ROCK CYCLE** is also found in your **ESRT** page 6!



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Okay...

Let's sum up!

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**There are 3 classifications of
ROCKS**

- **Igneous** – formed by the cooling of magma (melted rock)
- **Sedimentary** – formed by compaction & cementation of rock fragments
- **Metamorphic** – formed by heat & pressure changing existing rocks

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**Remember the “bells & whistles”
when identifying rocks!**



- **Igneous** – intergrown crystals either fine or coarse grained
- **Sedimentary** – layering, fragments, fossils
- **Metamorphic** – foliation, banding

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