

Topic 4: Rocks and Minerals

Part 1: Minerals

What is a Mineral?

- o A mineral MUST include these characteristics:
 - Naturally occurring
 - Inorganic: not made from anything that was once living
 - Solid
 - Crystalline structure
 - Have a definite chemical composition that is the same throughout.
 - The chemical composition tells what elements make up the mineral

Classifying Minerals

- o Use **page 16** of Earth Science Reference Tables
- o Minerals are classified based upon there:
 - Chemical composition
 - Observable properties which are determined by their internal arrangement of atoms:
 - **Color:** not the best test (some minerals can be more than one color)
 - **Cleavage:** breaking along smooth sides (due to weaker atomic bond arrangements)
 - **Fracture:** no distinct breaking pattern (due to equal bonding of atoms)
 - **Streak:** color of the mineral when powdered (use a streak plate)
 - **Luster:** how it reflects light (metallic or nonmetallic)
 - **Crystal Shape:** number of sides, pattern
 - **Special test:** acid test- Ex: calcite bubbles when acid is placed on it
 - **Hardness:** resistance to scratching

Moh's Hardness Scale

Index Mineral	Scale	Common Objects
Diamond	10	Steel file (6.5)
Corundum	9	
Topaz	8	
Quartz	7	
Orthoclase	6	
Apatite	5	Glass (5.5) Knife blade (5.1)
Fluorite	4	Wire Nail (4.5) Penney (3.5)
Calcite	3	Fingernail (2.5)
Gypsum	2	
Talc	1	

Mineral Uses

- o The **chemical composition** and **physical properties** determine how minerals are used by humans.
 - o *For example: Graphite is soft and has a dark gray streak...that is why we use them in pencils.*

Part 2: Rocks

What are Rocks?

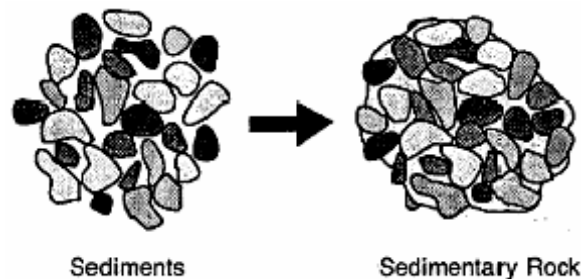
- o Are composed of 1 or more minerals.
- o Are classified as **SEDIMENTARY**, **IGNEOUS**, or **METAMORPHIC** based on their:
 - **Origin:** how it formed
- o Conditions/ environment that existed when a rock formed can be inferred from the rock's mineral content and texture.
- o The properties of rocks determine how they are used, and also influence land usage by humans.

Sedimentary Rocks (ESRT Page 7)

o **Clastic Sedimentary Rocks** : made from fragments of land-derived sediments

- Steps on how clastic sedimentary rocks form:

- 1) Need sediment (broken rock pieces)
- 2) Erosion: sediment is carried away either by wind, water, gravity
- 3) Deposition: sediments are dropped and settled
- 4) After sediments have been deposited, sedimentary rocks can be formed by:
 - a. **Compaction**: As sediments build up, they begin to squeeze together into layers
 - b. **Cementation**: Sediments are “glued” together by dissolved minerals in water



- The sediments are always OLDER than the actual rock.

o **Crystalline Sedimentary Rock**

- **Precipitates**: made from dissolved sea shells or minerals sinking to ocean floor
- **Evaporites**: when sea water evaporates, the dissolved minerals in the water are left behind and form a rock

o Ex: Rock Salt, Rock Gypsum, Dolostone

o **Bioclastic Sedimentary Rock**: made from organic (once living) materials

- Ex: Coal- made from plants

o Some sedimentary rocks can be Crystalline or bioclastic

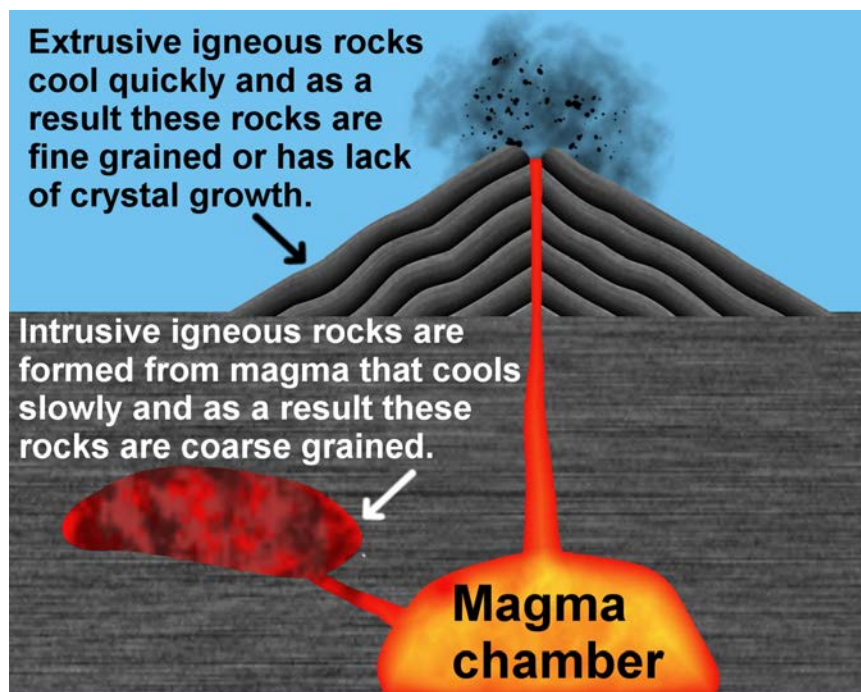
- Ex: Limestone- made from fossil sea shells

Igneous Rocks (ESRT Page 6)

- o Igneous rocks form due to **melting** and **solidification of lava or magma**.
 - Lava: above Earth's surface
 - Magma: below Earth's surface
- o Igneous rocks are made up of **intergrown crystals** of minerals.
 - The size of these intergrown crystals is determined by the cooling rate of the molten material.
 - The **slower** the magma cools, the **larger** the mineral crystals.
 - The **faster** the magma cools, the **smaller** the mineral crystals.
 - Igneous rocks can be **intrusive** or **extrusive**.

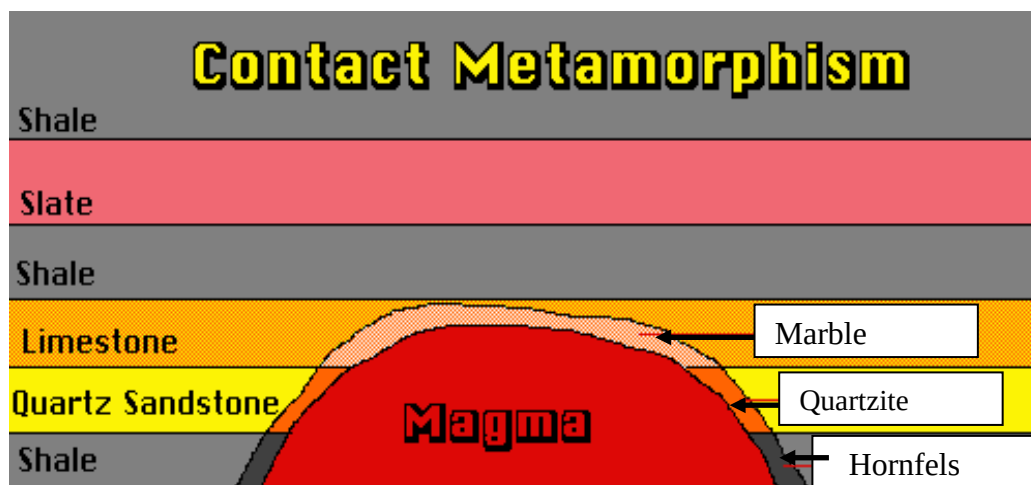
<i>Type of Igneous Rock</i>	<i>Where it forms</i>	<i>Forms from</i>	<i>Rate of Cooling</i>	<i>Size of crystals</i>
Intrusive	Below Earth's surface	Magma	Slow	Large
Extrusive	Above Earth's surface	Lava	Fast	Small

- o **Vesicular**: Igneous rock with gas pockets in it
- o **Glassy**: Igneous rock that is non-crystalline (no mineral crystals)



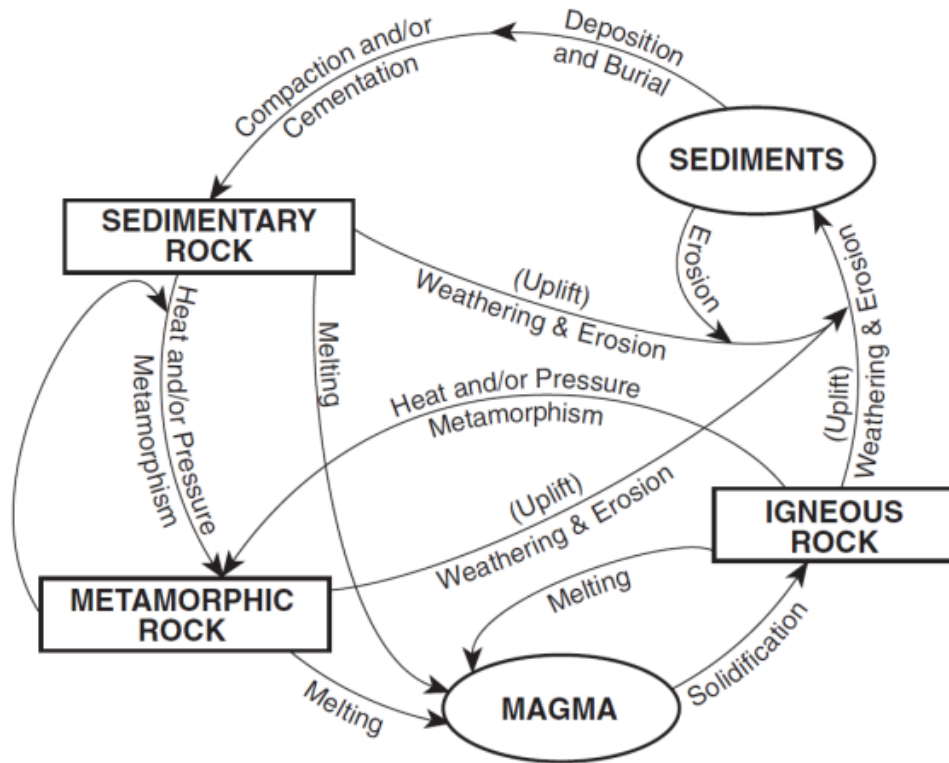
Metamorphic Rocks (ESRT Page 7)

- o Rocks that have changed in form due to **heat** and **pressure**
 - Heat comes from inside the Earth.
 - Pressure comes when Earth's plates slide or push together and from the weight of layers pushing down on top of one another.
- o Two types of Metamorphism
 - **Regional Metamorphism:**
 - Tectonic plates collide, creating heat and pressure, which transforms the rocks
 - Regional means over a large area (km's)
 - **Contact Metamorphism:** when older rocks come in contact with hot magma



- o Types of Metamorphic Rock
 - **Foliated Metamorphic Rocks:** have bands or layers of mineral crystals that formed under heat and pressure
 - **Nonfoliated Metamorphic Rock:** do not have bands or layers because minerals are not flat and were not subjected to a directional pressure

The Rock Cycle (ESRT Page 6)



1. Follow the arrow from sedimentary rock to metamorphic rock. What processes are necessary to change a sedimentary rock to a metamorphic rock? **Heat and/or pressure**
2. Follow the arrow from sediments to sedimentary rock. How do sediments become sedimentary rock? **Deposition, burial, compaction, and cementation**
3. How does magma form? **From melting rock**
4. How does magma become an igneous rock? **From solidification**
5. How does an igneous rock become a metamorphic rock? **Heat and/or pressure**
6. How does a metamorphic rock become an igneous rock? **Melting to magma, then solidification**
7. How do sediments form? **Uplift, weathering, and erosion**