Name _____ Date_____ Period _____

Rocks and Minerals Notes

Mineral – a naturally occurring, inorganic, solid that has a definite chemical composition and crystal structure.

How do minerals form?

1. from cooling magma/lava
2. when water evaporates and dissolved minerals are left behind (minerals "precipitate" out of solution

Identifying Minerals

Minerals can be identified by their physical and/or chemical properties.

Physical Properties Used for Mineral Identification:

1. Color
2. Streak
3. Luster
4. Hardness
5. Cleavage and Fracture
6. Density

1. Color: Some minerals have only one color (ex. sulfur is always yellow) while other minerals can be more than one color (ex. quartz, can be green, red, black, brown, pink, purple…)

2. Streak: The color of the powder when the mineral is rubbed on a streak plate.

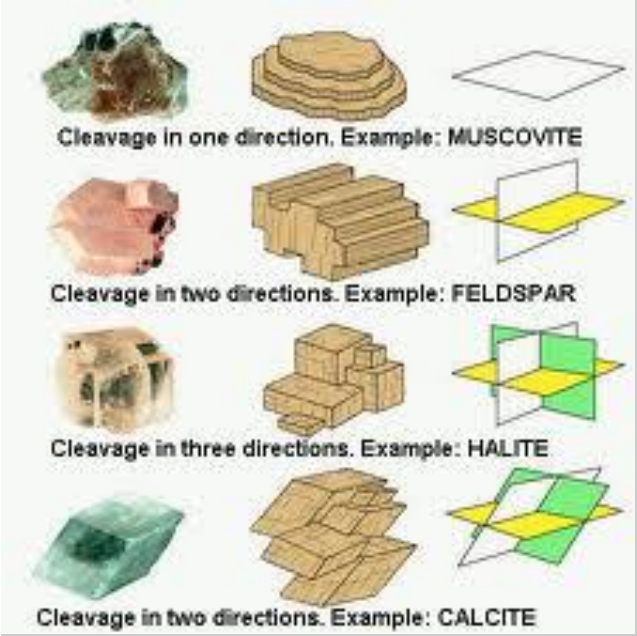
3. Luster: The way a mineral shines or reflects light from it surface. Can be metallic (ex. galena, pyrite, graphite) or non-metallic (ex. quartz, glassy, talc, waxy, mica, pearly).

4. Hardness: A measure of how easily a mineral can be scratched.

mineral	Mohs relative hardness scale	scratch test	other facts
talc	1	scrapeable with fingernail	used in talcum powder
gypsum	2	scrapeable with fingernail	ingredient of plaster
calcite	3	scratch with copper coin	used in cement
fluorite	4	scratch with a nail	used in toothpaste
apatite	5	scratch with a nail	mineral in bone
feldspar	6	scratch with steel file	ingredient in glass, etc.
quartz	7	scratches window glass	used in glass, etc.
topaz	8	scratches glass	gemstone
corundum	9	scratches topas	rubies & saphires
diamond	10	scratches corundum	"womans best friend"

The mineral's internal structure (the strength of the bonds between the atoms) determines the hardness of the mineral.

5. Cleavage and Fracture: Cleavage is when a mineral splits along smooth, flat surfaces. Fracture is when a mineral breaks unevenly into jagged pieces with rough surfaces.



What determines if a mineral has cleavage or fracture? The internal structure of the mineral (the types of bonds between the atoms). If there are weak bonds the mineral shows cleavage, if the bonds are strong the mineral will show fracture.

6. Density: Due to the kinds of atoms a mineral contains, and how closely packed the atoms are; different mineral samples of the same size have different densities.

Other Mineral Properties

Chemical Properties: Calcite reacts with hydrochloric acid. It forms bubbles of carbon dioxide gas.

Magnetic: Magnetite is naturally magnetic.

Conductor: Quartz conducts electricity.

Uses of Minerals

Ores: An ore is a mineral that contains metals and non-metals that can be mined and removed in usable amounts for a profit. Some examples of minerals that contain valuable ores are galena (contains lead) and hematite (contains iron).

List some uses for the following minerals:

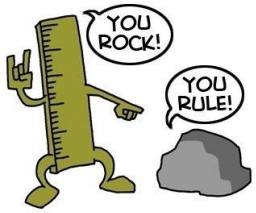
1. gypsum – dry-wall
2. sulfur – match tips
3. talc – powder
4. graphite – pencils
5. calcite – cement

Gems – minerals that have the following desirable qualities: hardness, color, luster, clarity, durability, and rarity.

Precious Stones – diamonds, rubies, sapphires, emeralds

Rocks

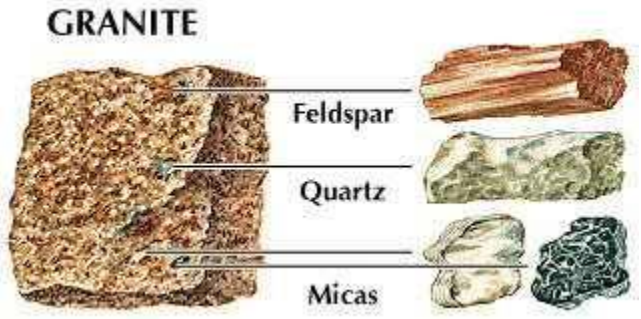
Petrology – the branch of science that studies rocks



Rock Classification

Rocks are classified based on their formation and origin. Many kinds of rocks are composed of minerals.

Some rocks are monomineralic meaning they are composed of one mineral (ex. limestone-calcite). Some rocks are polymineralic meaning they are composed of two or more minerals (ex. granite).



Letters:Words Minerals:Rocks

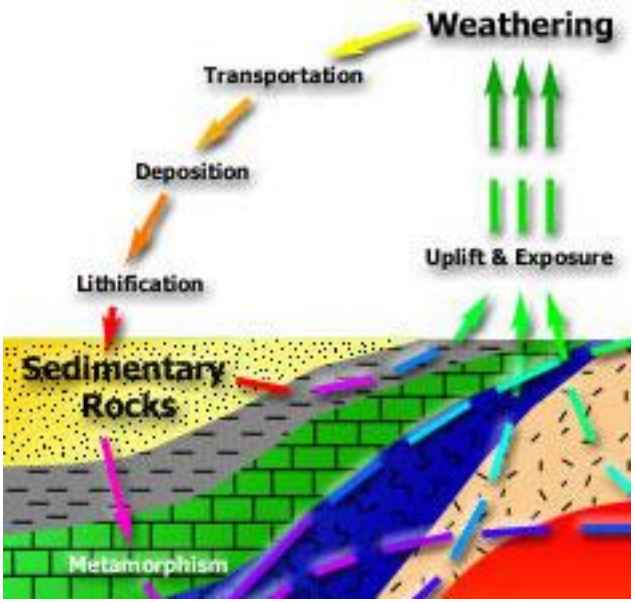
There are almost 3000 types of minerals, but only 8 of these minerals make up 90% of the rocks of Earth's crust.

The 3 groups of rocks are:

1. Sedimentary
2. Igneous
3. Metamorphic

Sedimentary Rocks

Sedimentary rocks are rocks that usually form in layers from the accumulation of sediments, organic material, or chemical precipitates. Most sedimentary rocks are made up of solid sediments that have been weathered from other rocks. The weathered sediments are then eroded (transported) by water, wind, and glaciers. Eventually the eroded sediments are deposited at new locations either in water or on land. Most sedimentary rocks form in layers underwater in lakes, seas or oceans.

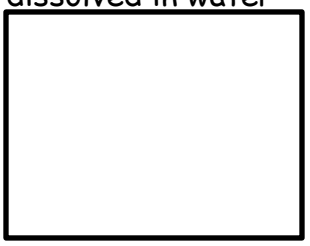


Fossils are mainly found in sedimentary rocks.

Types of Sedimentary Rock

1. <u>Clastic</u> – form from rock particles or sediments that are compacted and cemented together.

individual particles of rock sediment → pressure ↓ → natural sediments dissolved in water



after deposition → compaction → cementation

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	

2. <u>Chemical</u> – form from dissolved minerals in water that settle out/precipitate (dissolved minerals left behind when water evaporates)

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	

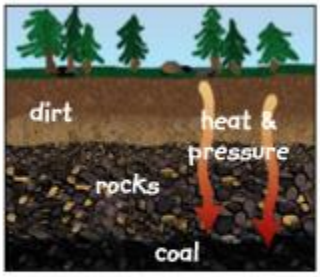
3. <u>Organic</u> – form from the accumulation of plant/animal matter that undergoes a transformation into rock

Bioclastic	Microscopic to coarse	Calcite	Cemented shell fragments or precipitates of biologic origin	Limestone	
	Varied	Carbon	From plant remains	Coal	

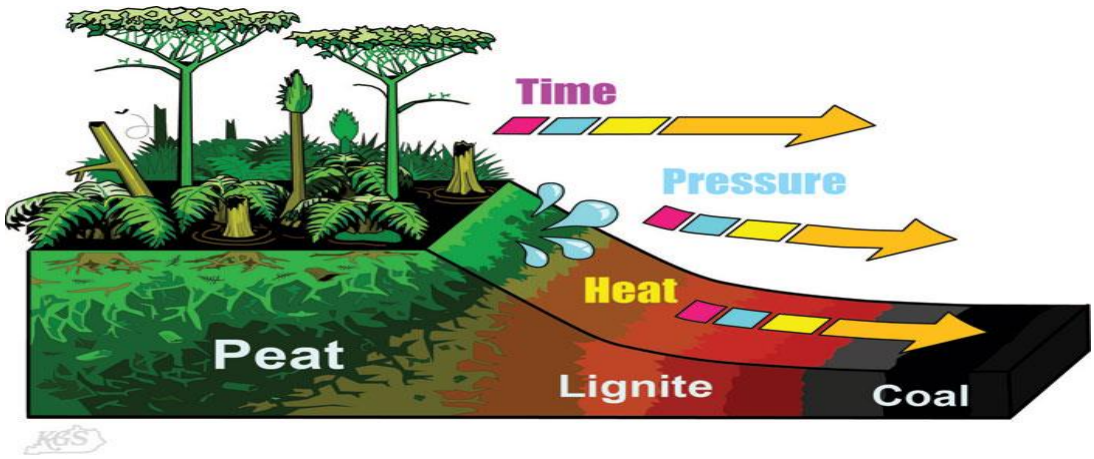
Coal Formation

Swamps with giant plants hundreds of millions of years ago covered the earth.

Water and dirt covered the plant remains 100 million years ago.



Rocks, dirt and sediment created pressure and heat to form coal deep in the ground.



Peat = accumulated plant material

Lignite = brown coal (soft)

Anthracite coal = metamorphed soft coal into hard coal

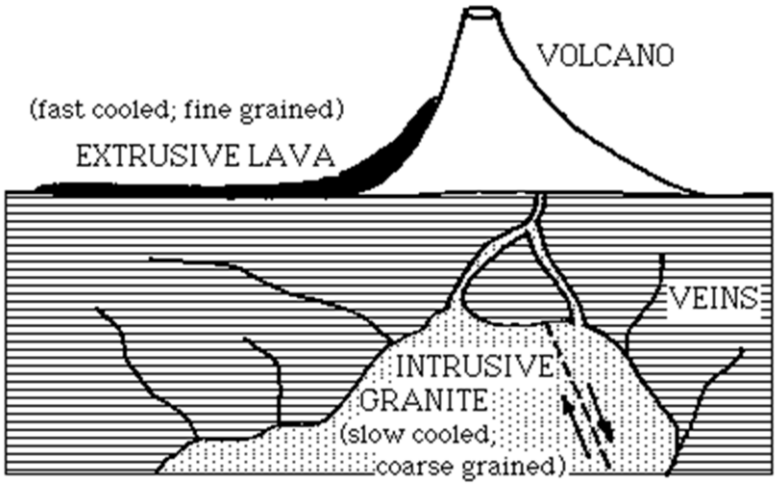
Igneous Rock

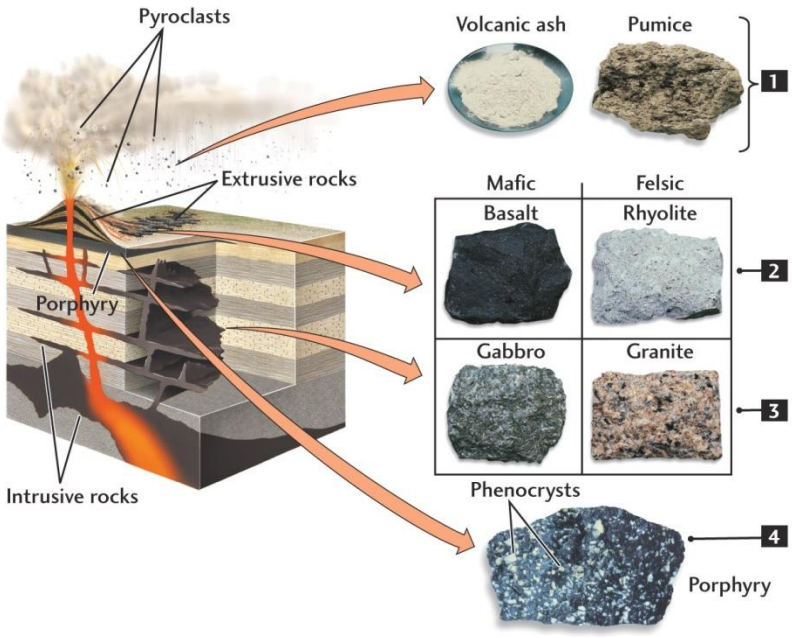
Igneous rocks form from the cooling and solidification/crystallization of molten lava and magma. When molten (liquid) lava or magma cools and solidifies, crystals of different minerals form the rock.

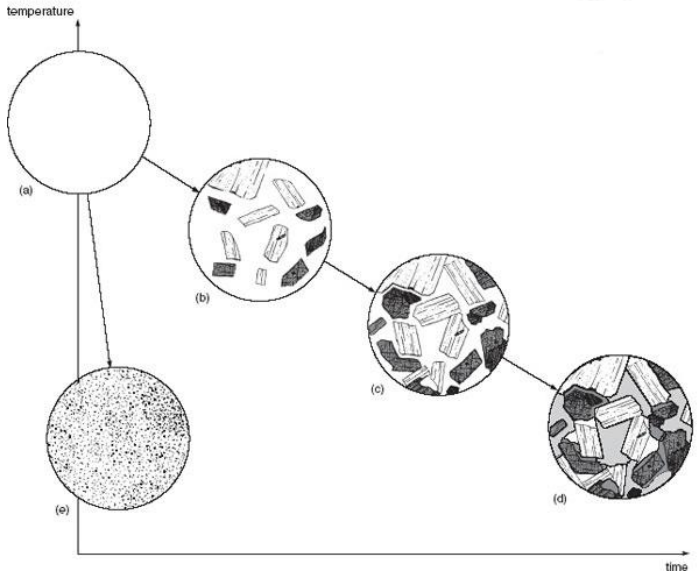
Types of Igneous Rock

1. Extrusive/Volcanic – forms from the fast cooling of lava on Earth's surface. Fast cooling does not allow time for crystals to grow. Rocks have small to no crystals, therefore they have a smooth, fine texture.
   example – obsidian

2. Intrusive/Plutonic – forms from the slow cooling of magma within the Earth. Slow cooling allows time for large crystals to grow. Rocks have large crystals; therefore they have a coarse, rough texture.
   example – granite







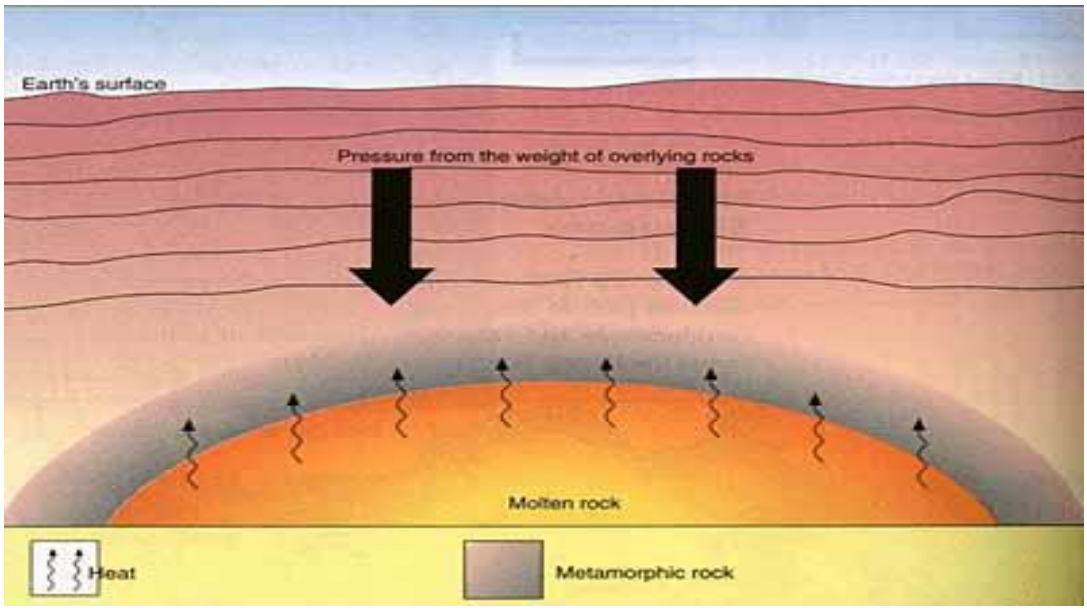
Metamorphic Rock

Metamorphic rocks form from other preexisting rocks (sedimentary, igneous, and metamorphic) that have been changed.

Conditions that cause rocks to undergo metamorphism include:

1. heat
2. pressure
3. chemical activity

Such conditions are often associated with deep burial and pressure that result from mountain formation. Therefore, metamorphic rocks are often found in mountain regions. Under conditions of high temperature and high pressure, many metamorphic rocks form by the process or recrystallization. This is the growth of new mineral crystals from the crystals of an igneous or metamorphic rock. **Recrystallization occurs without true melting.**

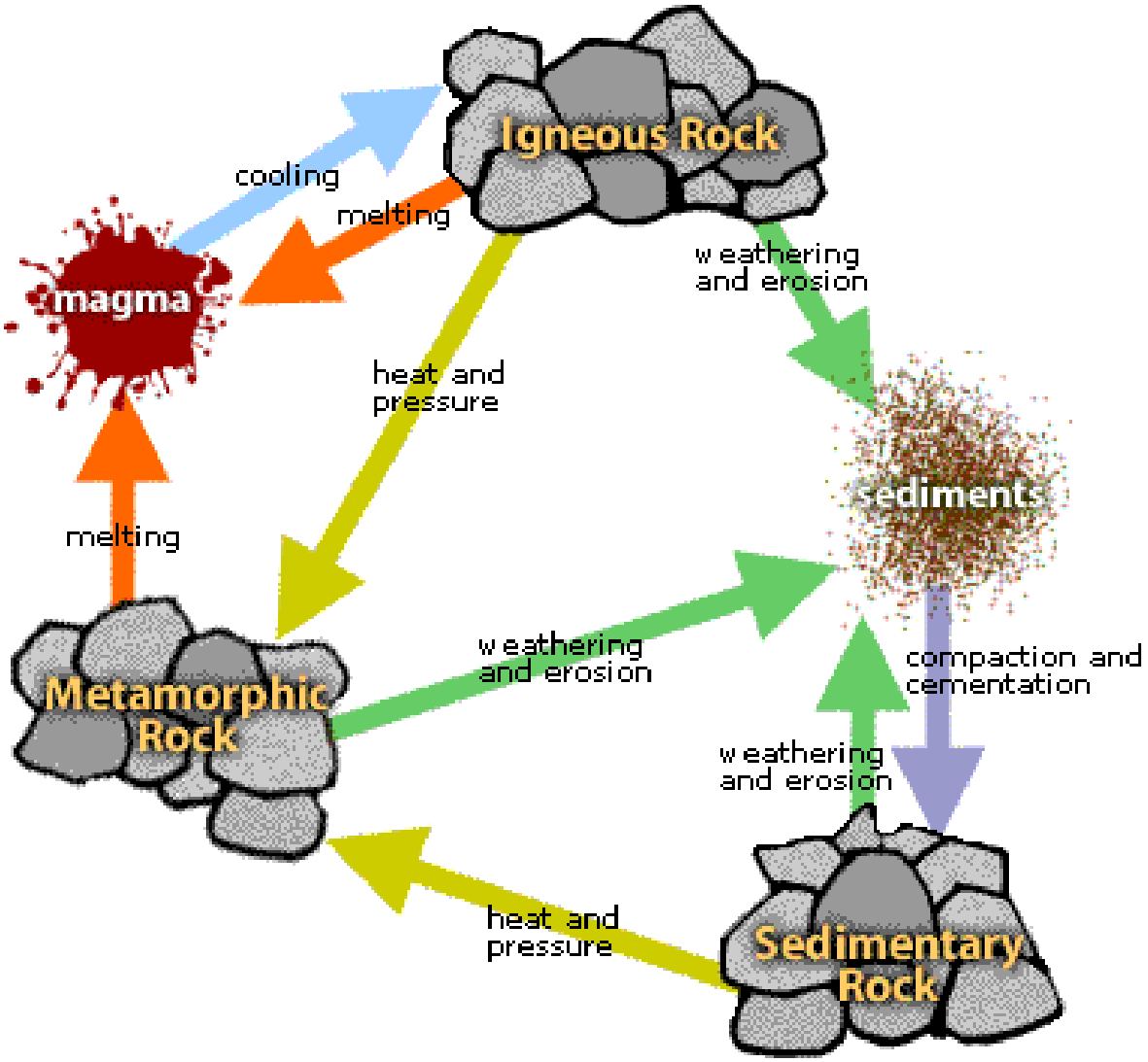


Banding can occur in rocks that undergo metamorphism. Banding is a layered arrangement of firmly joined mineral crystals; the minerals are aligned in layers or bands. These bands are formed when rock is subjected to extreme pressure and temperature. Usually, the greater the pressure and temperature, the thicker the bands.

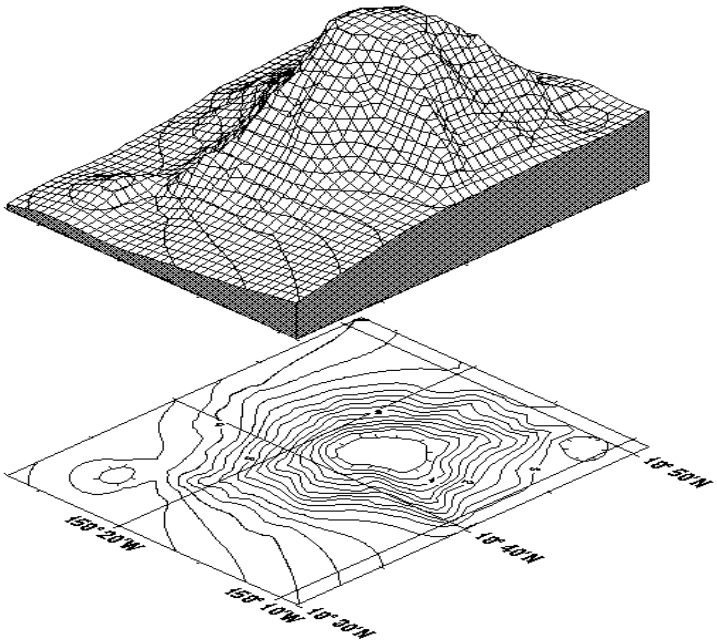
Banded gneiss

Types of Metamorphic Rocks

1. Foliated – have mineral crystals arranged in parallel layers or "bands"
   ex. – slate, gneiss, schist
2. Non-foliated – do not have mineral crystals in bands, do not break into layers or sheets.
   ex. - marble, quartzite, anthracite coal



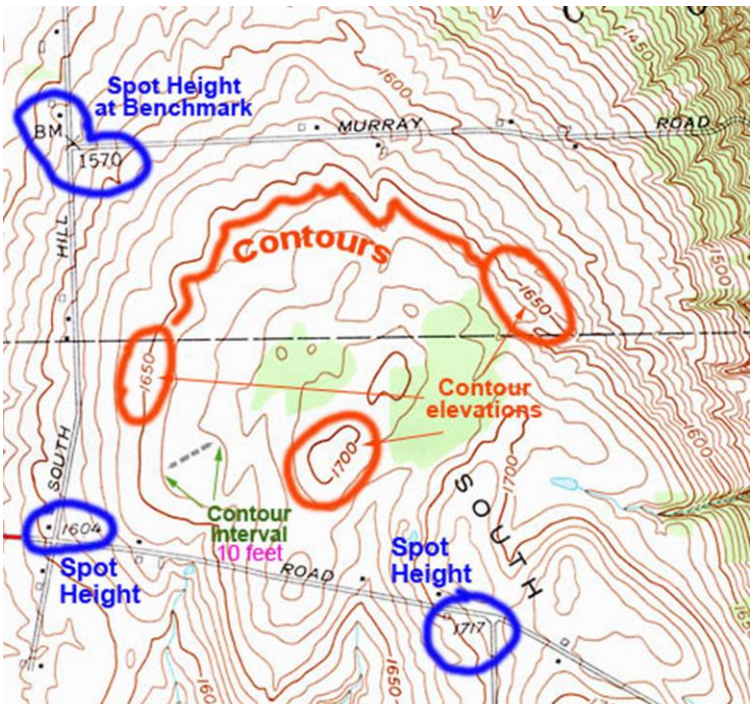
Topographic Map – a map showing the surface features of an area



Topographic maps provide highly accurate information on the elevation, relief and slope of the surface ground.

To represent elevation, relief and slope on topographic maps, mapmakers use contour lines.

Contour Interval – the change in elevation from contour line to contour line



Weathering, Erosion and Deposition

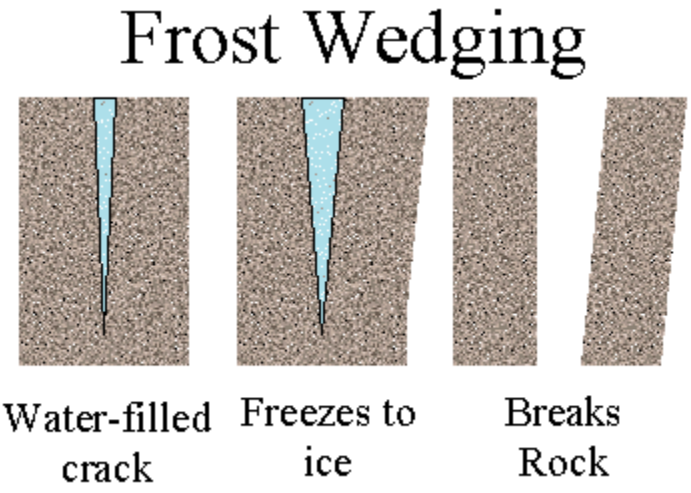
Weathering – the physical and chemical breakdown of rock into smaller particles called sediments.

Types of Weathering

Mechanical Weathering (Physical) – any process that causes a rock to crack or break into pieces without changing it chemically

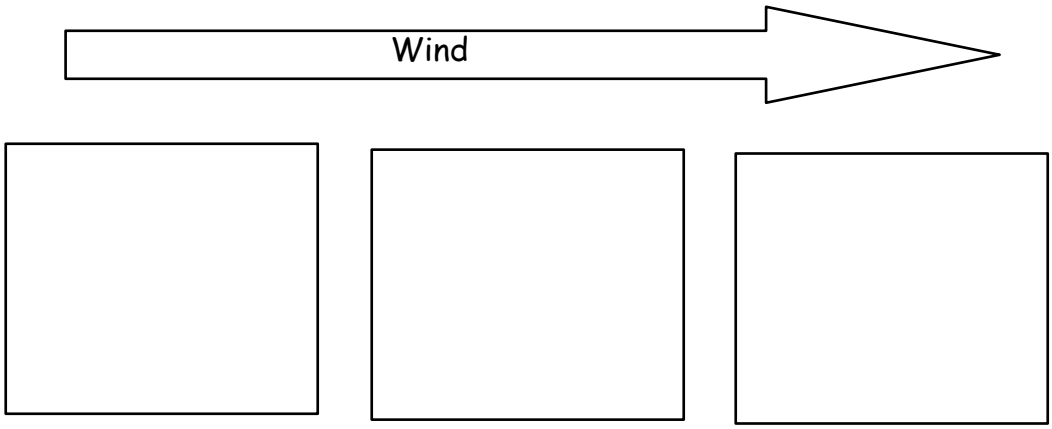
examples:

1. Ice (Frost) Wedging – occurs when water seeps into cracks in rocks, freezes and expands and then thaws – this causes the rock to break

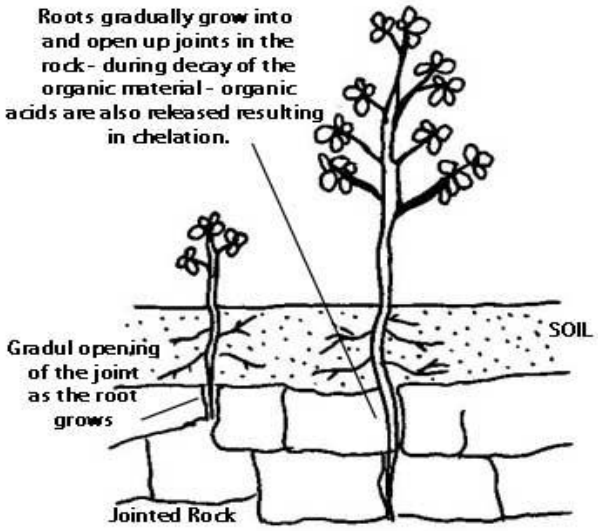


apart over time. *potholes are caused by ice wedging*

2. Abrasion – occurs when sediments are carried by streams or wind, collide into each other and the surrounding rock



3. Organic (plant) Activity – occurs when tree roots or plant roots grow through cracks in rock causing it to break apart.



Chemical Weathering – occurs when rocks are broken down by chemical action and their mineral composition changes as a result

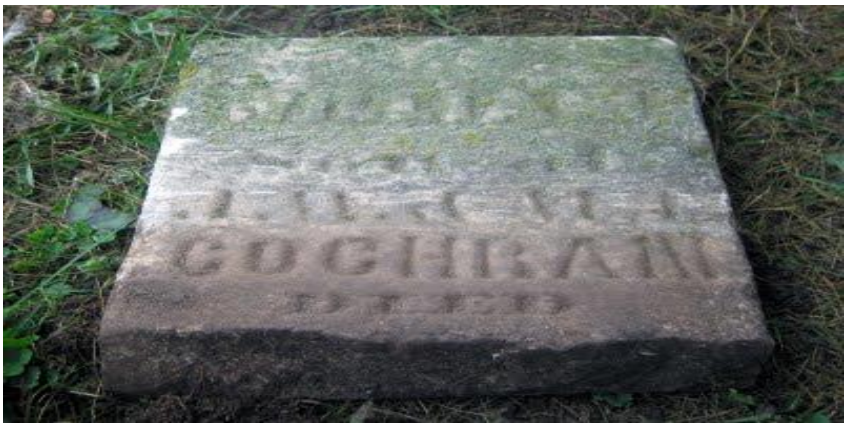
Agents of Chemical Weathering

1. Water- water is the most important agent of chemical weathering. Water weathers rock by dissolving them. Over time, many rocks will dissolve in water.

2. Oxidation - can cause iron to rust. Iron, combines with oxygen in the presence of water in a process called oxidation.

The product of oxidation is rust.

3. Carbonation - when carbon dioxide becomes dissolved in rain-water, it forms a weak acid called carbonic acid (otherwise known as ACID RAIN). Carbonic acid easily weathers marble and limestone. This is because the mineral calcite which is found in marble and limestone, reacts with the acid in the rain water.



III. Rates of Chemical Weathering

** The most important factors that determine the rate at which weathering occurs are **rock type** and **climate**.**

1. **Rock Type**

   A. Some kinds of rocks weather more rapidly than others. The minerals that make up the rock determine how fast it weathers.

   B. Rock made of minerals that do not dissolve easily in water weathers slowly.

   C. Rock made of minerals that dissolve easily in water weathers faster.

2. **Climate** - refers to the average weather conditions in an area.

   A. Both physical and chemical weathering occur faster in wet climates.

   B. Chemical reactions occur faster at warmer temperatures.

Erosion and Deposition

Erosion - the process by which weathered sediments are carried/transported.

1. An agent of erosion is a material or a force that moves sediments from one place to another.

2. Agents of erosion include: wind, running water, glaciers, and waves.
GRAVITY is the underlying force behind all erosion.

Running water is the major agent of the erosion that has shaped Earth's land surfaces.

Runoff - water that flows over the land and eventually makes its way back to the ocean.

Because of gravity, runoff and the material it contains move downhill.

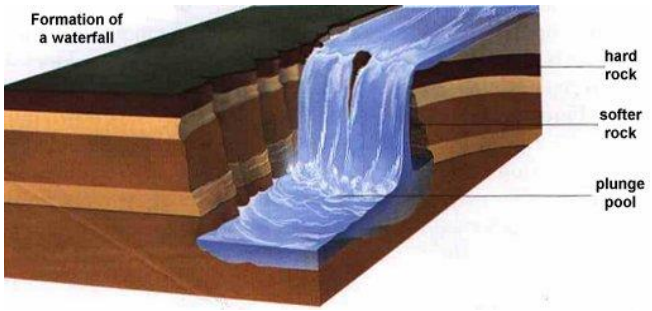
2. The amount of runoff in an area depends on **five main factors**.
   1. **amount of rain** an area receives
   2. **vegetation** – reduces runoff by absorbing water and holding soil in place
   3. **type of soil** – some soils absorb more water than other
   4. **shape of the land** – steep slope = greater runoff
   5. **paved areas** – paved parking lots = increased runoff

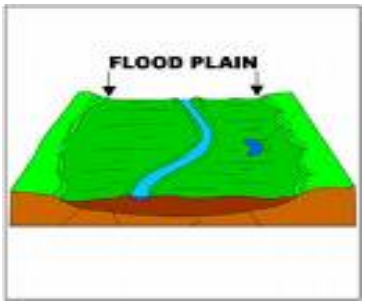
Running Water Erosion

1. All runoff will eventually make its way to a tributary. A tributary is a stream that flows into a larger stream.

2. When streams, rivers, creeks, etc. are high, the water flows faster, which causes more erosion to take place.

3. Through erosion, a river creates valleys, waterfalls, flood plains, meanders, and oxbow lakes.





Deposition

Sediments are carried along in moving water and in wind. When the water velocity or wind velocity slows down, the sediment drops or deposits; this "dropped" sediment is known as deposition.

Deposition creates landforms such as deltas.