Inside Earth

Geology - the study of planet Earth.

Geologist - scientist who studies the forces that make and shape planet Earth.

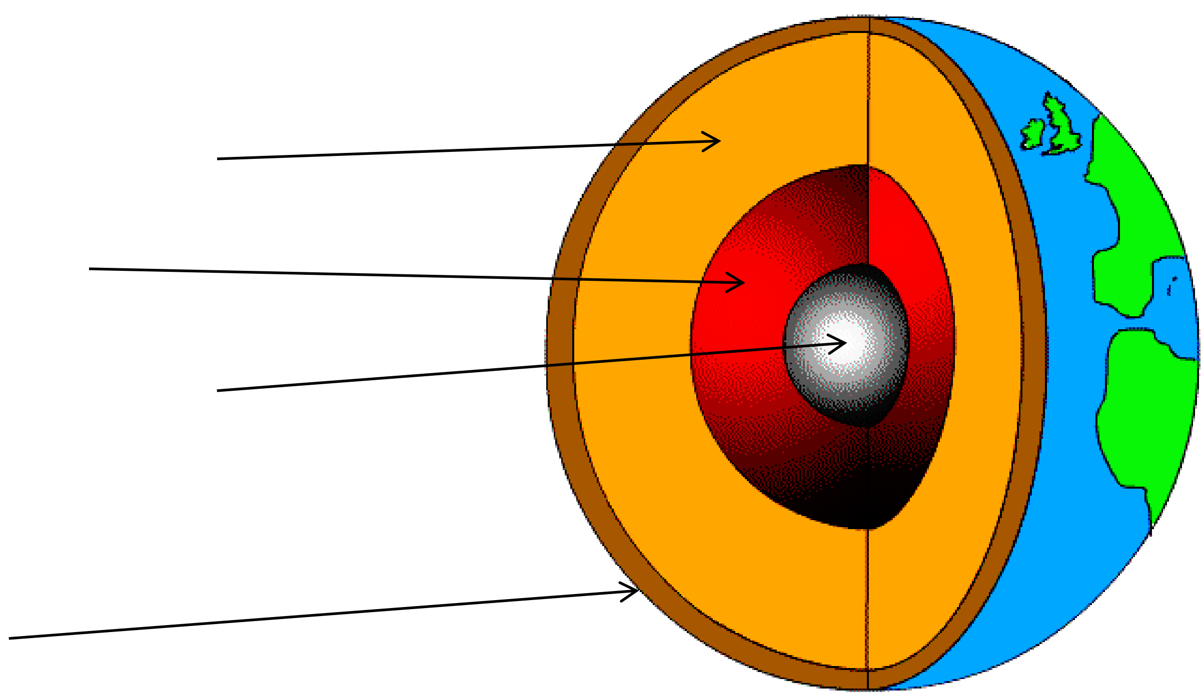
Constructive force - shape the surface by building up mountains and landmasses

Destructive force – slowly wear away mountains and eventually every other feature on the surface

Journey to the Center of the Earth

As you travel beneath Earth's surface (from crust to core), the temperature and pressure increase.

The Earth is divided into 4 layers:



1. **Crust** – a layer of rock that forms Earth's outer skin. On the crust you'll find rocks, mountains, soil & water. (Ocean crust – basalt Continental crust - granite)

2. **Mantle-** a layer of hot rock below the crust, the crust and upper mantle are similar

lithosphere- upper most part of the mantle and crust together – very rigid layer (litho = stone)

asthenosphere- soft layer below the lithosphere that can flow slowly
**** the lithosphere floats on top of the asthenosphere****

3. **Outer Core-** layer of molten material surrounding the inner core, made of iron and nickel

4. **Inner Core-** dense ball of solid metal

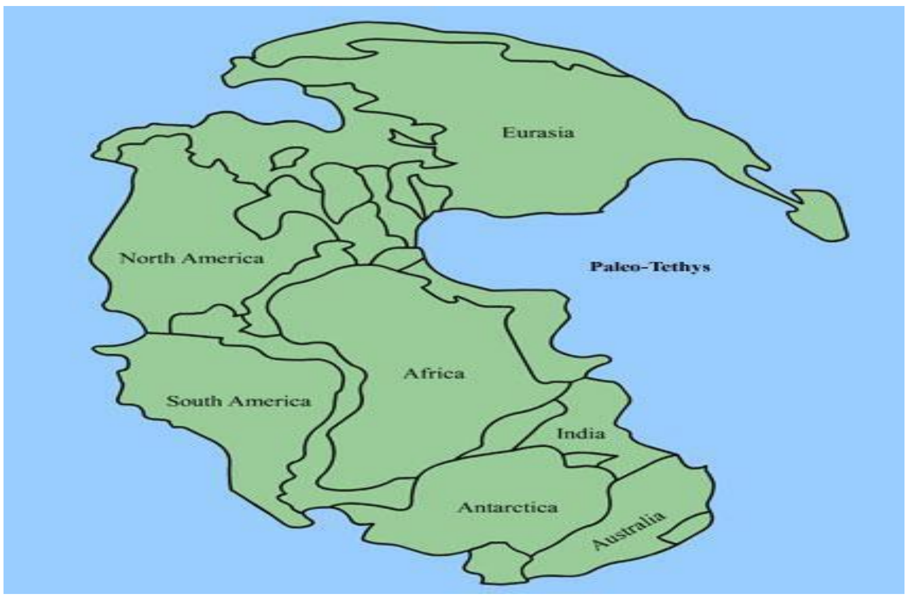
Depth	Name of Layer	What Layer is Made of
20 km	crust	Solid rock
150 km	asthenosphere	Soft material that can flow slowly
2,000 km	mantle	Hot but not solid
4,000 km	outer core	Molten iron and nickel
6,000 km	inner core	Solid iron and nickel

Drifting Continents

Alfred Wegener- German scientist who whose hypothesis was that all the continents had once been joined together in a single landmass and have since <u>drifted</u> apart.

Wegener named this supercontinent Pangaea.

Wegener's idea that the continents slowly moved over Earth's surface became known as continental drift.



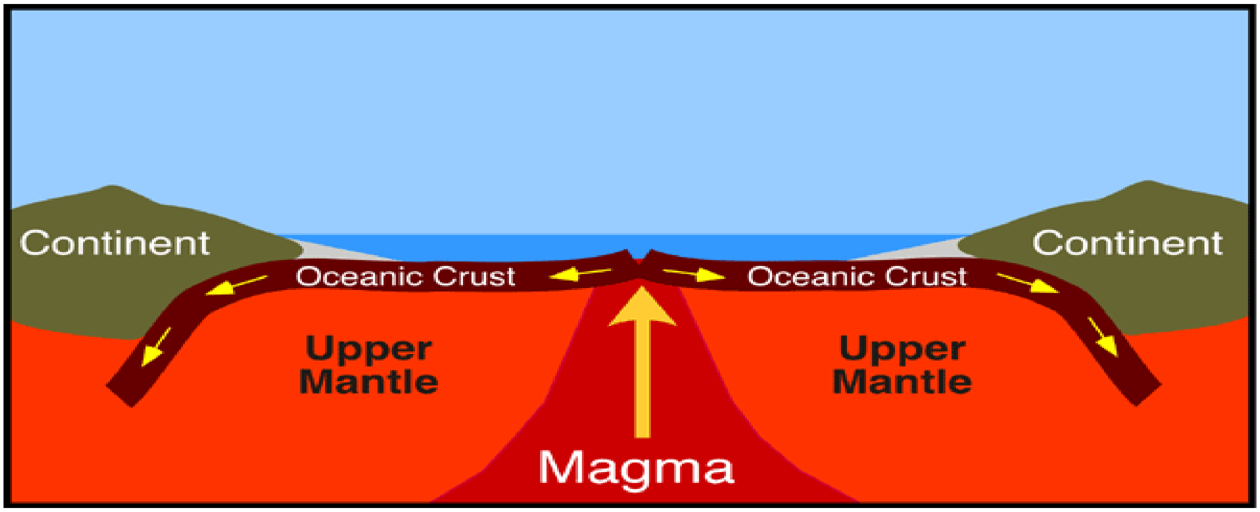
Evidence of Pangaea (Pangaea means "All Earth")

1. land forms – fit together like a jig-saw puzzle

2. fossils – fossils of reptiles found in places now separated by oceans

3. climate – coal formed in NYS tells us that NYS was once warm and swampy (remember coal only forms in warm, swampy environments)

Sea-Floor Spreading



At the mid-ocean ridge, molten material rises from the mantle and erupts. The molten material then spreads out, pushing older rock to both sides of the ridge.
This process continually adds new material to the ocean floor and is known as Sea-floor spreading.

Evidence of sea-floor spreading includes:
1. molten material
2. reverse magnetism
3. drill-core sampler

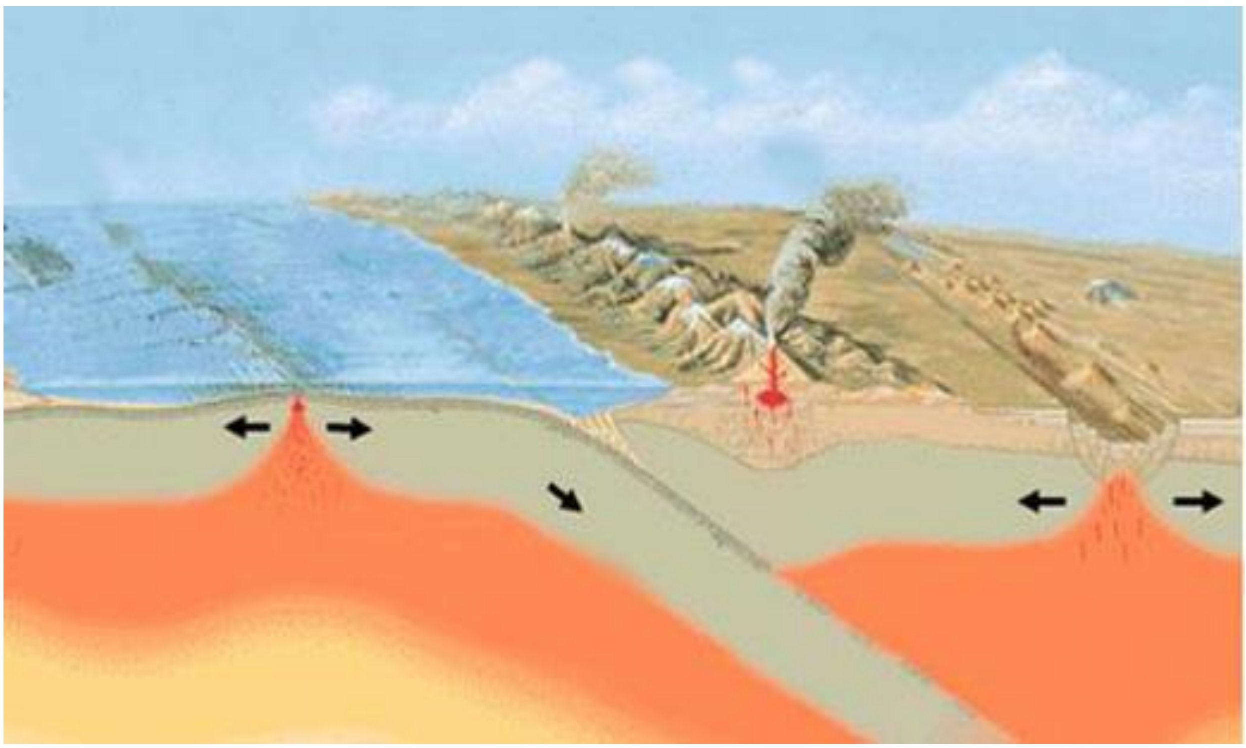
1. "Pillow-like" rocks found on the ocean floor provide us with evidence of sea-floor spreading. These structures indicate to us that there are repeated eruptions of molten material.

2. Iron-bearing minerals at mid-ocean ridges align themselves with Earth's magnetic field. Over time, Earth's magnetism has changed polar position. Today, the minerals on the ocean floor are aligned to face north, just like a compass needle. In the past, the minerals have aligned themselves to face south (a compass needle would face south as well). This change in alignment has caused the ocean floor to become "striped" in appearance.

3. Drilling samples have shown that the rocks found near the mid-ocean ridge are younger than the rocks found farther away from the ridge. This gives us evidence that the sea-floor is in fact, spreading.

Subduction at Deep-Ocean Trenches

As the sea floor spreads, it just doesn't keep getting wider and wider. Instead, the ocean floor plunges into deep underwater canyons called trenches.
Subduction takes place where there are trenches.
Subduction is the process by which the ocean floor sinks beneath a trench and back into the mantle.



The Theory of Plate Tectonics

Plate tectonics-the Earth's surface consists of a number of rigid, but moving, pieces called plates. In some areas the plates are moving together, and in some other areas these plates are moving apart. The study of the movement and formation of these plates is called **plate tectonics**.

– the theory of plate tectonics explains the formation, movement, and subduction of Earth's plates.

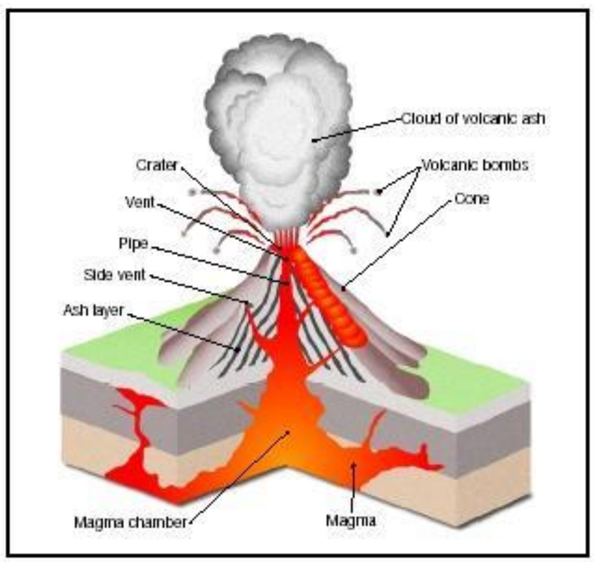
How do Earth's plates move? The plates rest on a layer of the mantle called the asthenosphere. Convection currents in the asthenosphere are the cause of plate movement.

As the plates move, they compress, pull, or grind past each other, producing changes in Earth's surface. These changes include mountains, rift valleys and earthquakes.

Volcano – a weak spot in the crust where molten material, or magma, comes to the surface.

Magma – a molten mixture of rock-forming substances, gases, and water from the mantle.

When magma reaches the surface it is called **lava**.

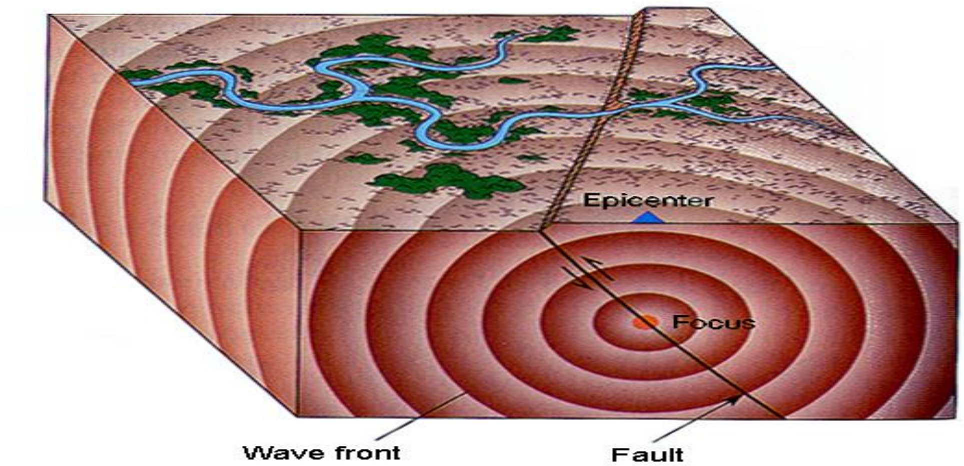


Most volcanoes occur along diverging plate boundaries, such as the mid-ocean ridge, or in subduction zones around the edges of oceans.

MEASURING EARTHQUAKES

Focus- the point beneath Earth's surface where rock that is under stress breaks, triggering an Earthquake. *Where the earthquake starts

Epicenter-the point on Earth's surface, directly above the focus



Seismic Waves - are vibrations that travel through Earth carrying energy released by an earthquake

**** Seismic waves carry the energy of an earthquake away from the focus, through Earth's interior, and across the surface.**

3 Categories of seismic waves: **1.** P-Waves (primary)
2. S-Waves (secondary)
3. Surface Waves

An earthquake sends out 2 types of waves from its focus: P-waves and S-waves. When these waves reach Earth's surface at the epicenter, surface develop.

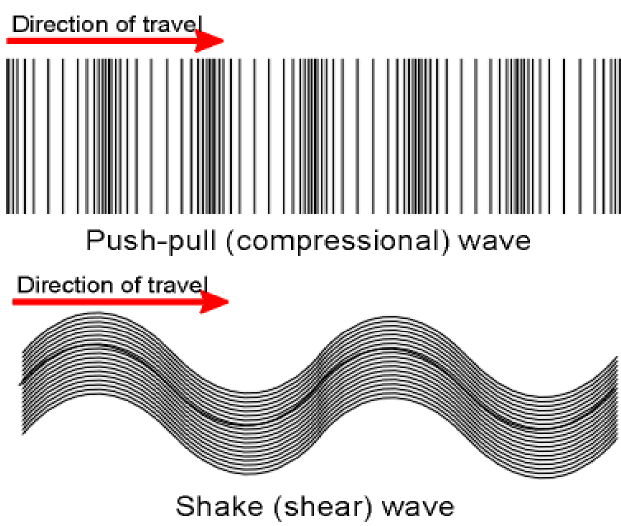
P waves

P waves are the first waves to arrive.
P waves travel faster than S waves.
P waves can pass through solids and liquids.
P waves are earthquake waves that compress and expand the ground like an accordion.

P waves cause buildings to expand and contract.

S waves

S waves are the second waves to arrive.
S waves travel slower than P waves.
S waves are earthquake waves that vibrate from side to side as well as up and down.
When S waves reach the surface, they shake structures by rocking the foundations.
S waves only travel through solids. They DO NOT travel through liquids or gases!



Surface Waves

When P waves and S waves reach the surface, some of them are transformed into surface waves.

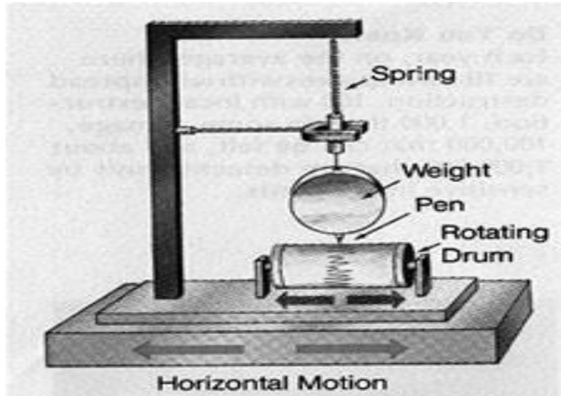
Surface waves move more slowly than P and S waves, but they produce the most damaging ground movements.

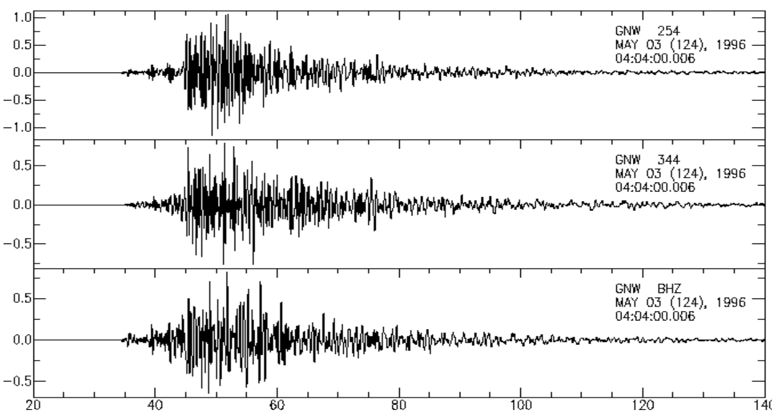
Some surface waves make the ground roll like ocean waves. Other surface waves shake buildings form side to side.

Detecting Seismic Waves and Measuring Earthquakes

Seismograph- records the ground movements caused by seismic waves as they move through Earth.

Seismograph





Seismogram

Magnitude-a measurement of earthquake strength based on seismic waves and movements along faults.

Mercalli Scale- a measure of the earthquake's intensity with 12 divisions, 1 (felt by very few) to 12 (total destruction).

Richter Scale- a numerical description of an earthquake's magnitude, has a base 10 logarithmic scale, so each increasing number is 10X stronger than the number before.
➓ the Richter Scale is the scale that we are accustomed to hearing about. When we watch the news, they will tell you the magnitude of an Earthquake according to the Richter Scale .

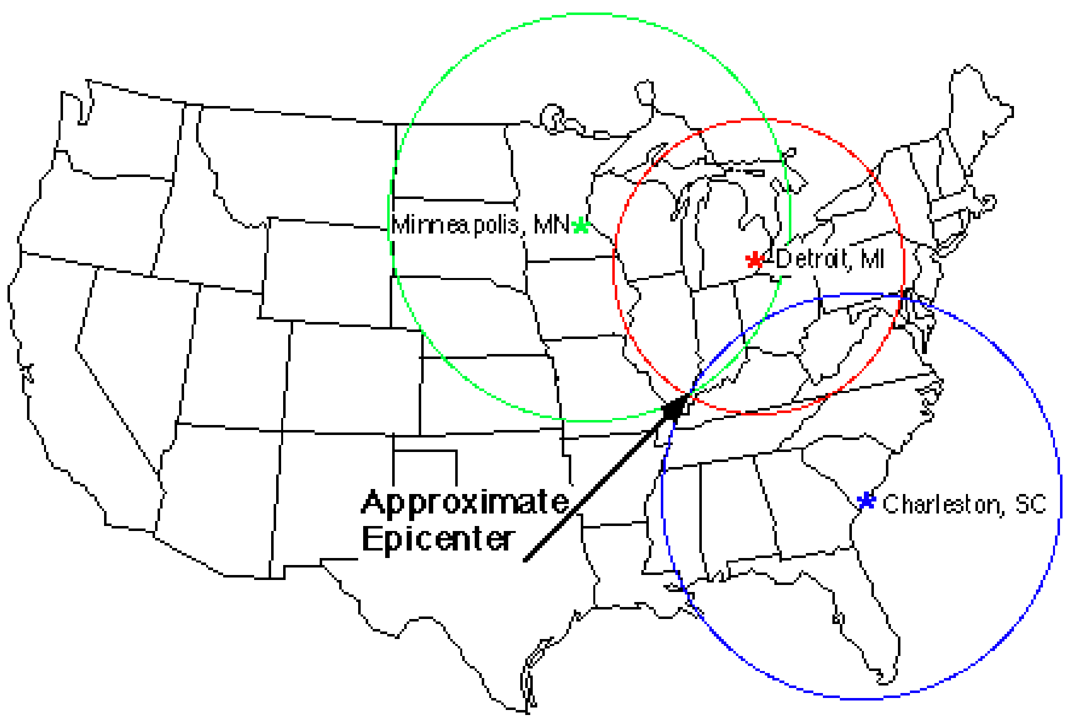
Moment Magnitude Scale – a scale of 1-10 that enables scientists to compare the energy released by different earthquakes on the basis of the area of the geological fault that ruptured in the quake.

Locating An Epicenter

Geologists use seismic waves to locate the epicenter of an earthquake. Seismic waves travel at different speeds. P waves arrive first at a seismograph, with S waves following close behind.

To tell how far the epicenter is from the seismograph, scientists measure the difference between the arrival times of the P waves and S waves. The farther away an earthquake is, the longer the time between the arrival of the P waves and S waves.

Geologists draw at least three circles using data from different seismographs set up at stations all over the world. The center of each circle is a particular seismograph's location. The radius of each circle is the distance from the seismograph to the epicenter. The point where the three circles intersect is the location of the epicenter.



Name: ___________________________________ Period __________

Weathering, Erosion and Deposition

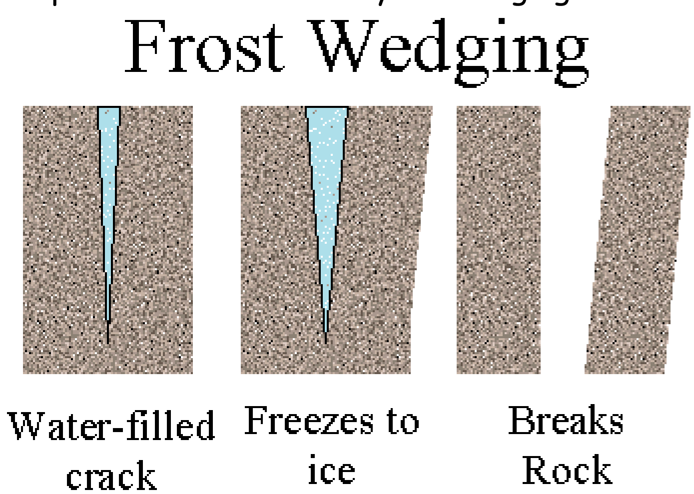
Weathering – the physical and chemical breakdown of rock into smaller particles called sediments.

Types of Weathering

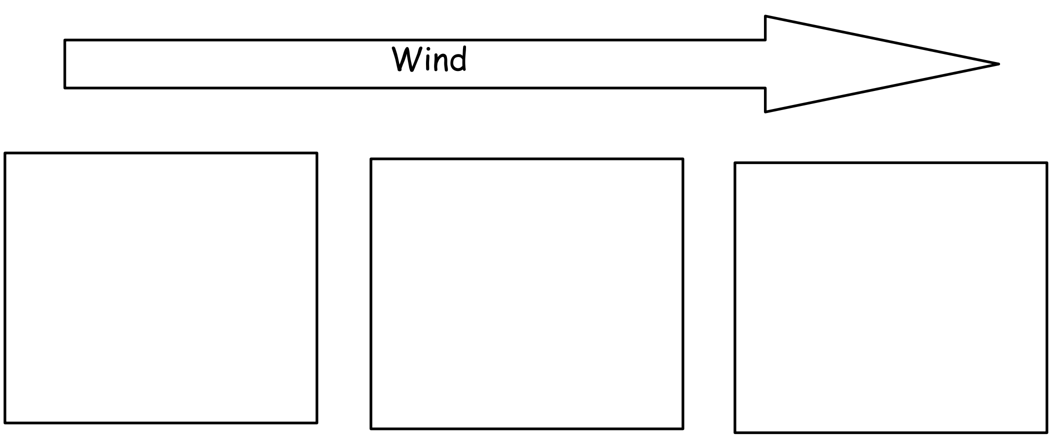
Mechanical Weathering (Physical) – any process that causes a rock to crack or break into pieces without changing it chemically

examples:

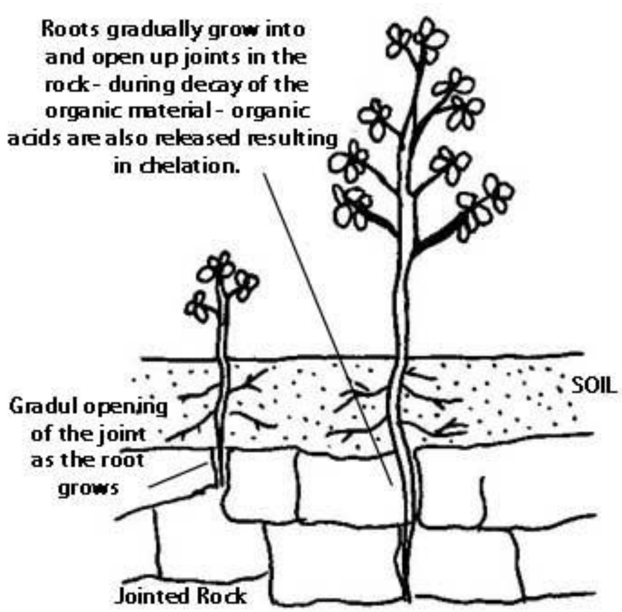
1. Ice (Frost) Wedging – occurs when water seeps into cracks in rocks, freezes and expands and then thaws – this causes the rock to break apart over time. *potholes are caused by ice wedging*



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. 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. <u>Carbonation</u> - 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

A. 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.

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

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

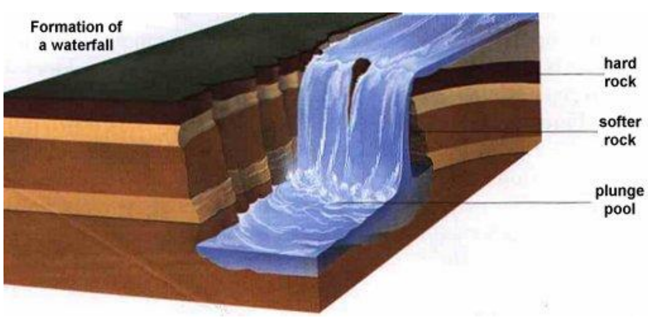
1. Because of gravity, runoff and the material it contains move downhill.

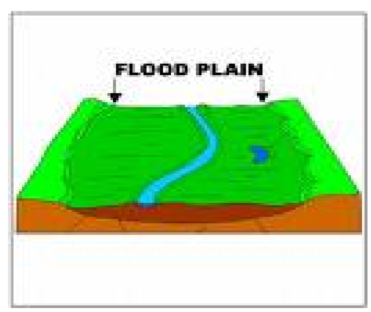
2. The amount of runoff in an area depends on **five main factors**.
   1. **amount of rain** an area receives
   2. **vegetation** – reduces runoff by absorbing water and holding soil in place

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

I. 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.

II. Deposition creates landforms such as deltas.