Geology Topics Unit Notes

Name:

(PLEASE DO NOT LOSE!)

- Continental Drift: The gradual movement of the continents across the earth.
- Plate tectonics - The earth's crust and upper mantle are broken into sections called plates. These plates float on the mantle like rafts (moving very slowly)

Evidence for Continental Drift

-The Shapes Match

-Same fossils found on different continents

- These are the pictures on the puzzle pieces.

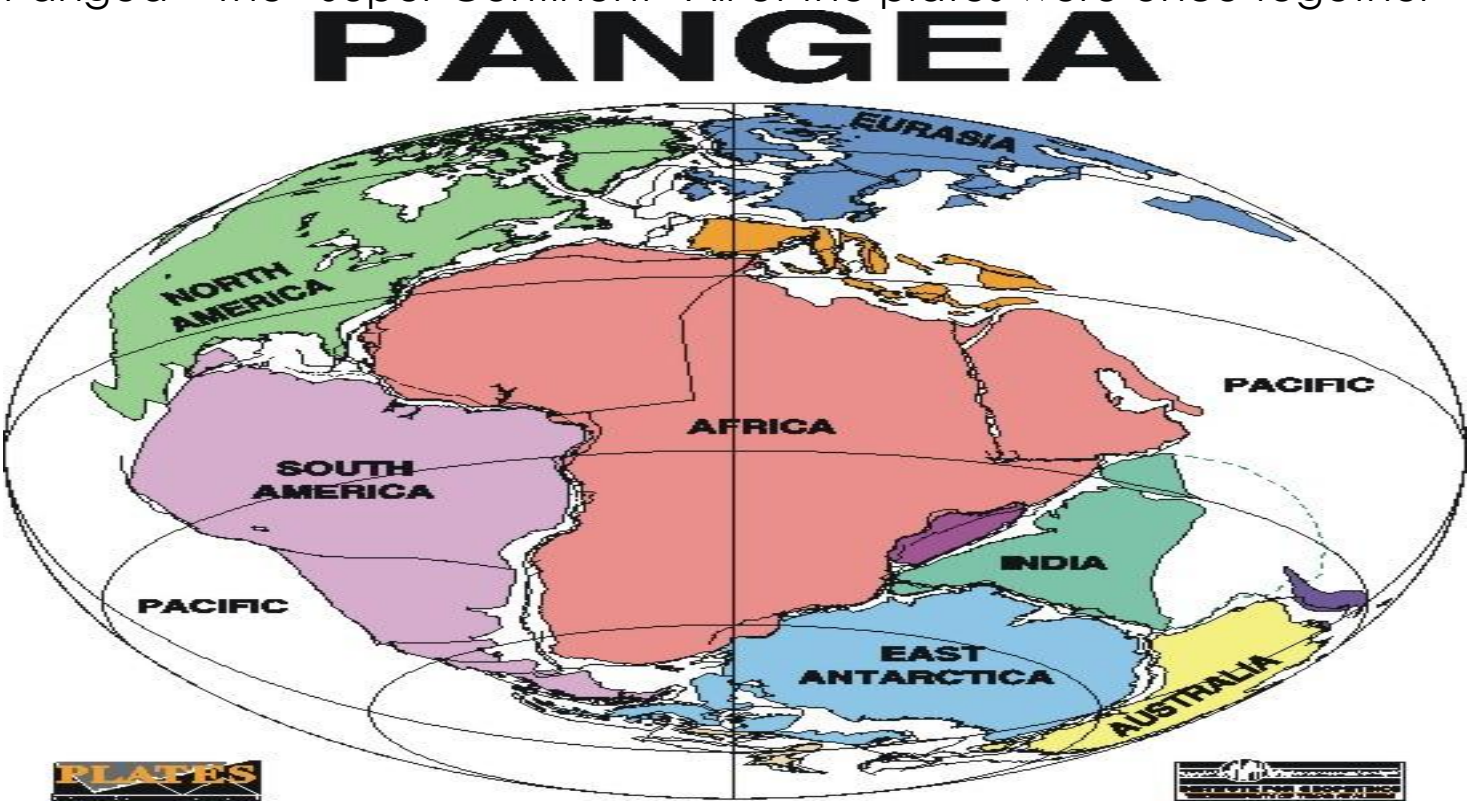
-The same rock structures on different continents

-Fossils of Trees and Animals in Antarctica

-Magnetic layers in sea floor spreading

Gondwondaland and Laurasia were two mega continents before Pangea.

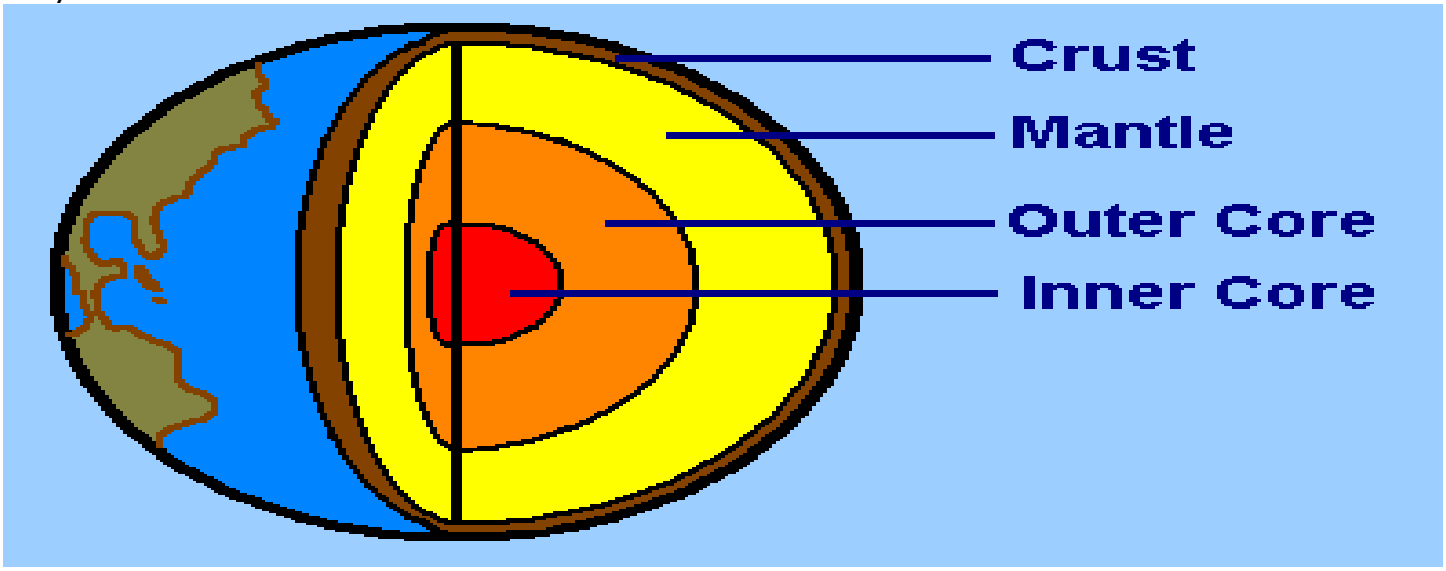
Pangea – The "Super Continent" All of the plates were once together



We know the material of the interior of the earth based on how P and S waves move through planet. (Both Body Waves)

- P Wave: Primary wave. Moves lateral and faster.
- S Wave: Secondary waves. Stronger and moves back and forth (Slower moving than P)

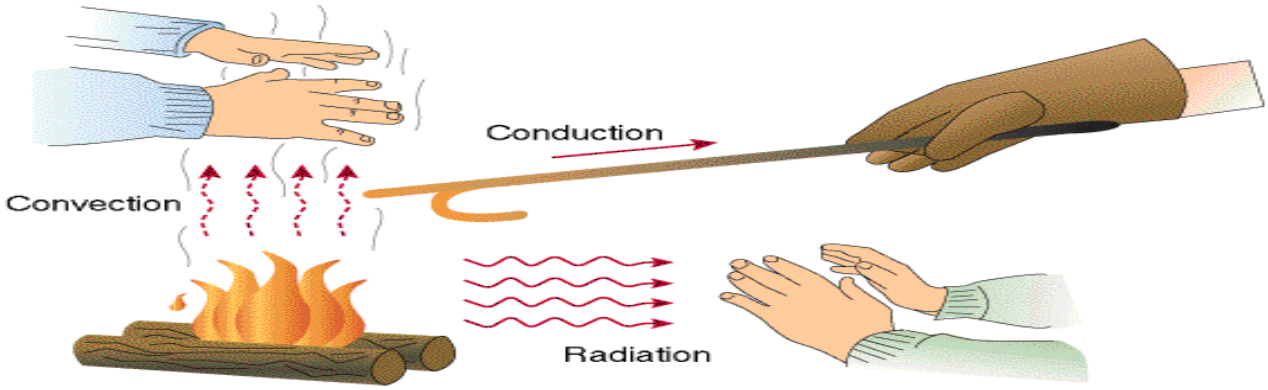
Layers of the Earth



- Layers formed early in Earth System History (Archean Eon) Gravity pulled heavy elements toward the middle.

- Inner Core: Solid Iron and Nickel (Dense).
- Outer Core: Liquid Iron and Nickel
- Mantle: Composed of Magnesium Silicates, Iron, Calcium
  - Outer Mantle (asthenosphere)
- Lithosphere: The outer part of the earth, consisting of the crust and upper mantle.
  - Lithosphere is broken into tectonic plates.

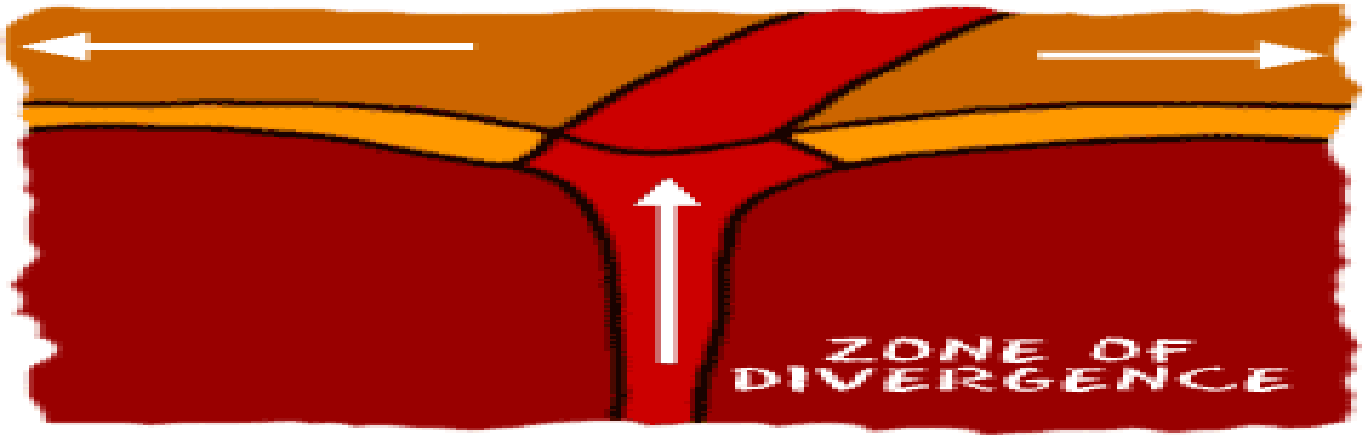
Pictures for heat transfer



Convection: Vertical circulation in which warm rises and cool sinks.
--Flow of heat by this circulation.
Conduction: The movement of heat from one molecule to another.
Radiation: Energy that is radiated or transmitted in the form of rays or waves or particles.
The two types of Crust
Ocean Crust (Basalt) Denser
Continental Crust (Granite) Less Dense

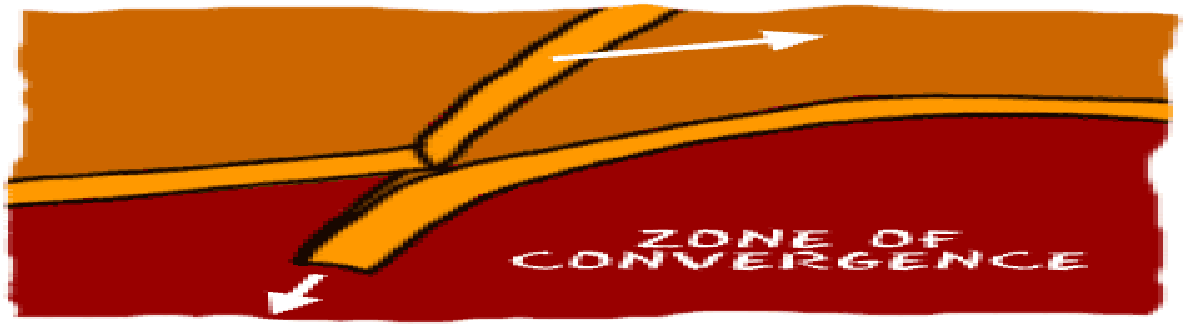
PLATE BOUNDARIES

Divergent Boundaries: At divergent boundaries new crust is created as two or more plates pull away from each other.

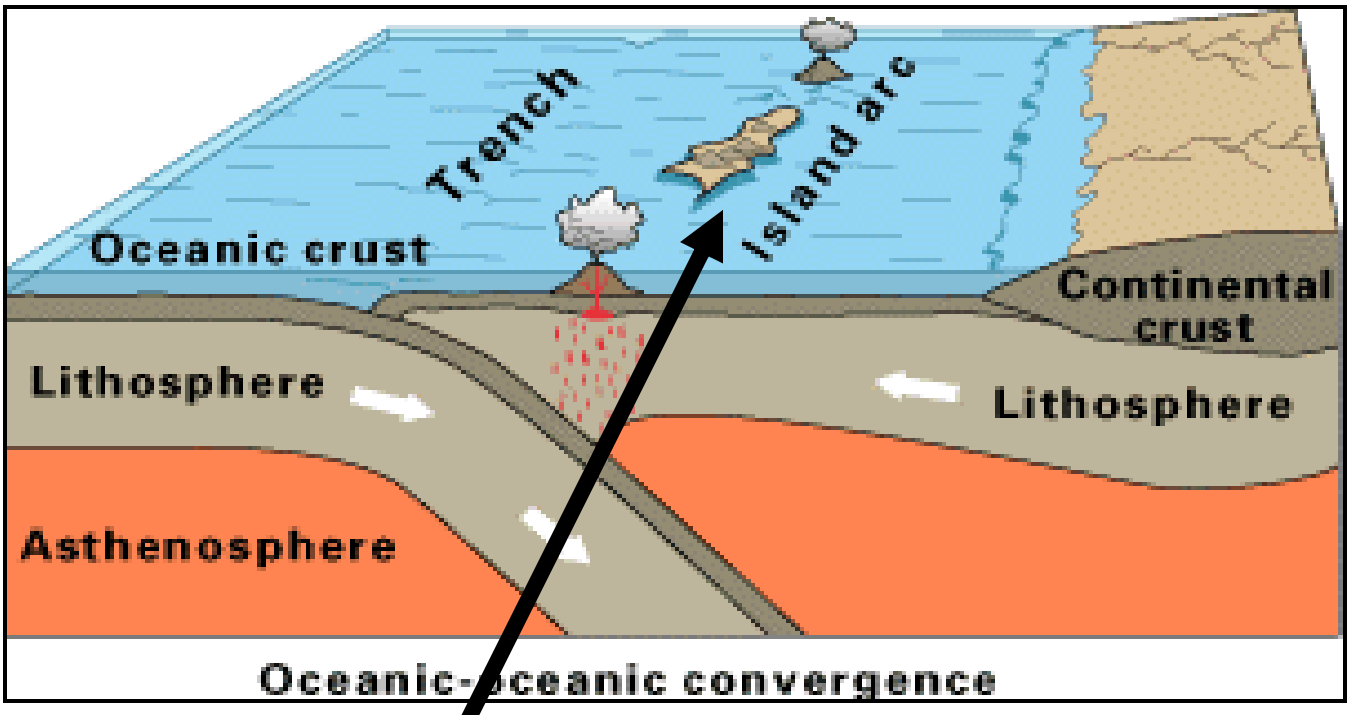


Mid-Atlantic Ridge is like a baseball because it encircles the earth, showing the places where new earth is formed.

Convergent Boundaries: Here crust is destroyed and recycled back into the interior of the Earth as one plate dives under another.

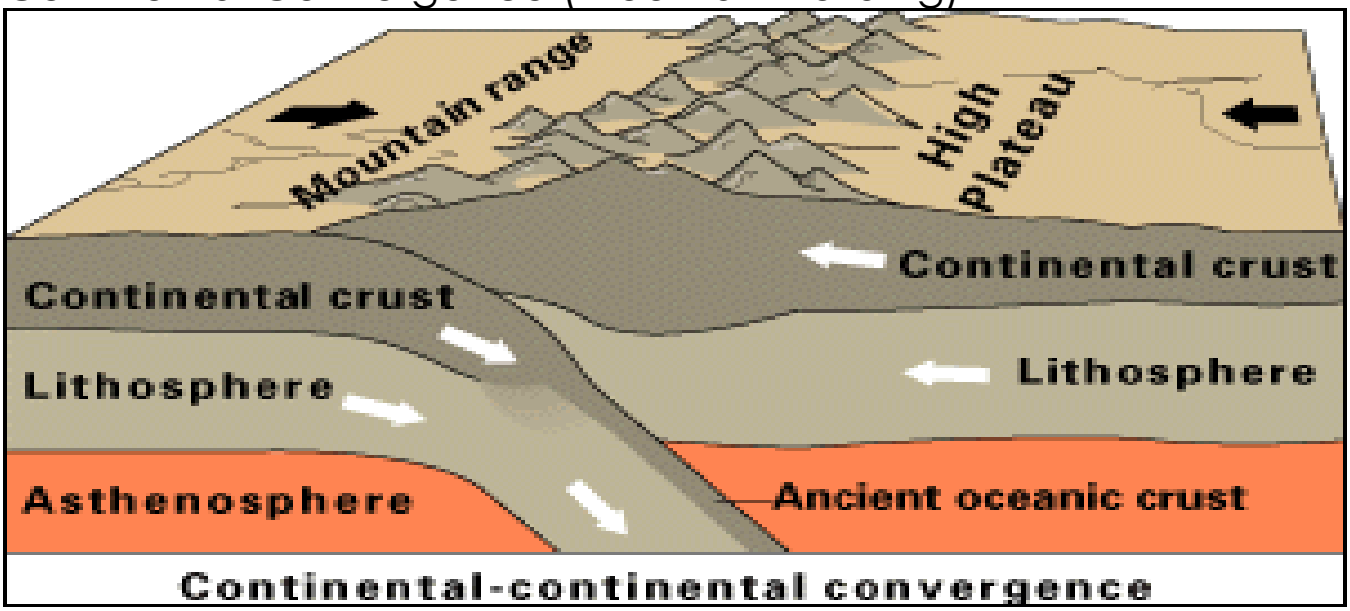
- 

Ocean Convergent: Two ocean plates collide and one goes under the other.

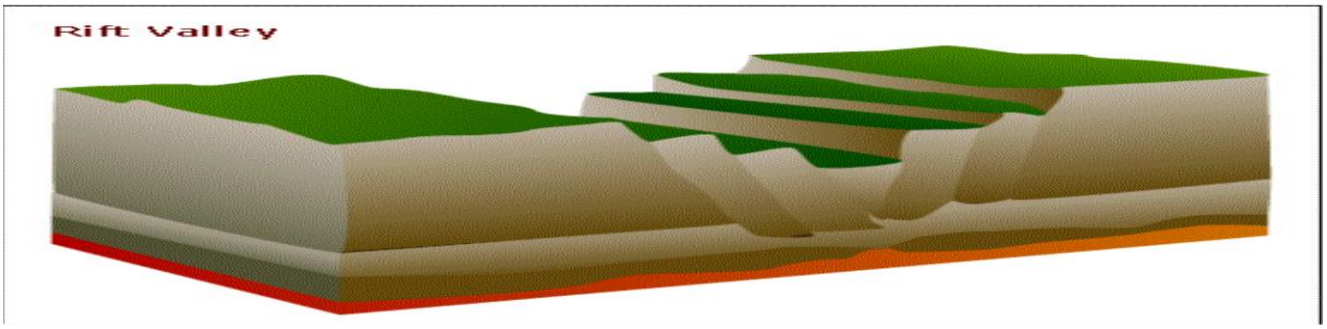


Archipelago (Island Arc) – Group of volcanic islands formed from ocean curst convergence.

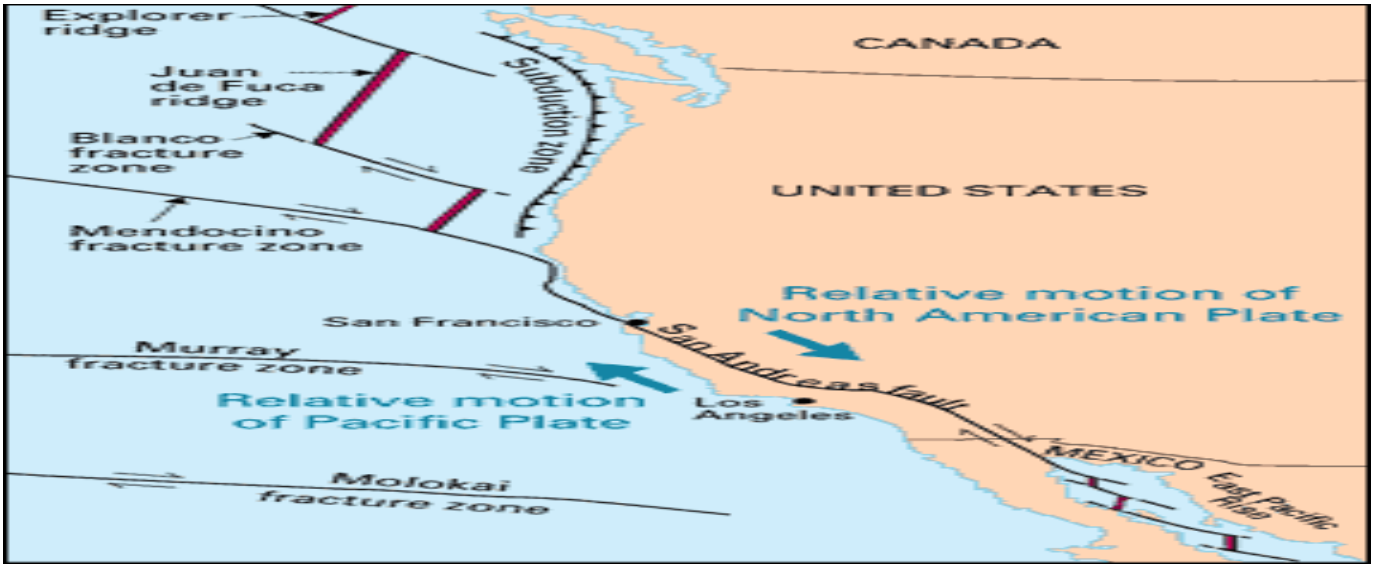
Continental Convergence (Mountain Building)



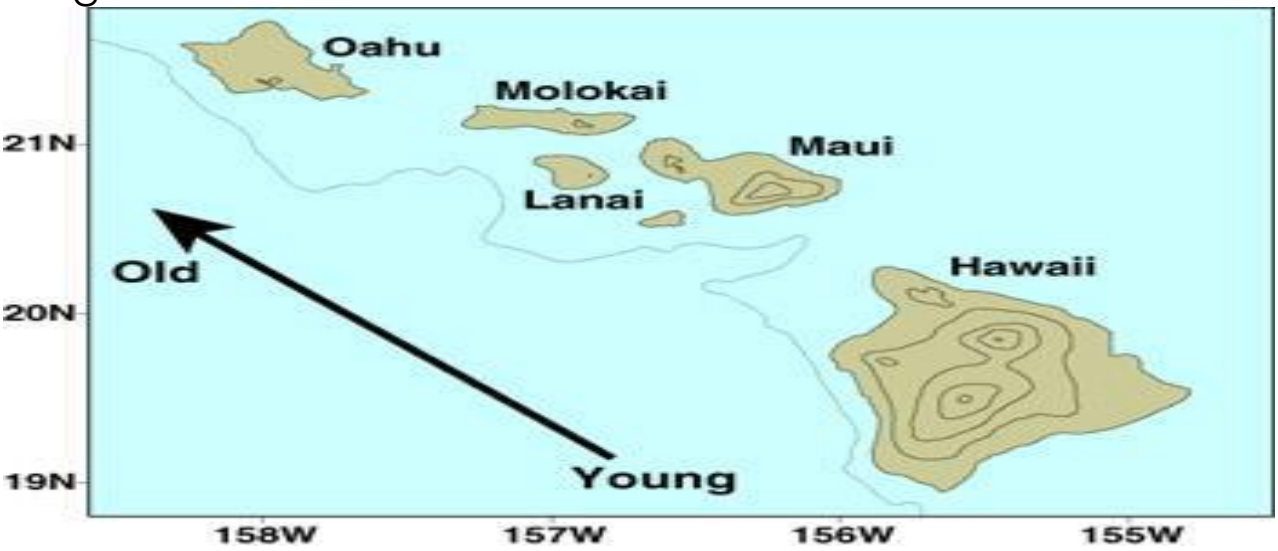
Continent Divergence (Moving apart) Rift Valley



Transform-Fault Boundaries: Where two plates are sliding horizontally past one another. (To be discussed more later)



Hawaii is caused by a hot spot: A location above an upwelling of magma from the mantle.



VOLCANOES

- Volcano - An opening in the Earth's crust through which molten magma and gases erupt.

The Negatives of Volcanoes

- Death and Destruction
- Loss of land until…?, Permanent loss of structures.
- Release of poisonous and greenhouse gases.

- Eruptions can have a tremendous impact on global climate.

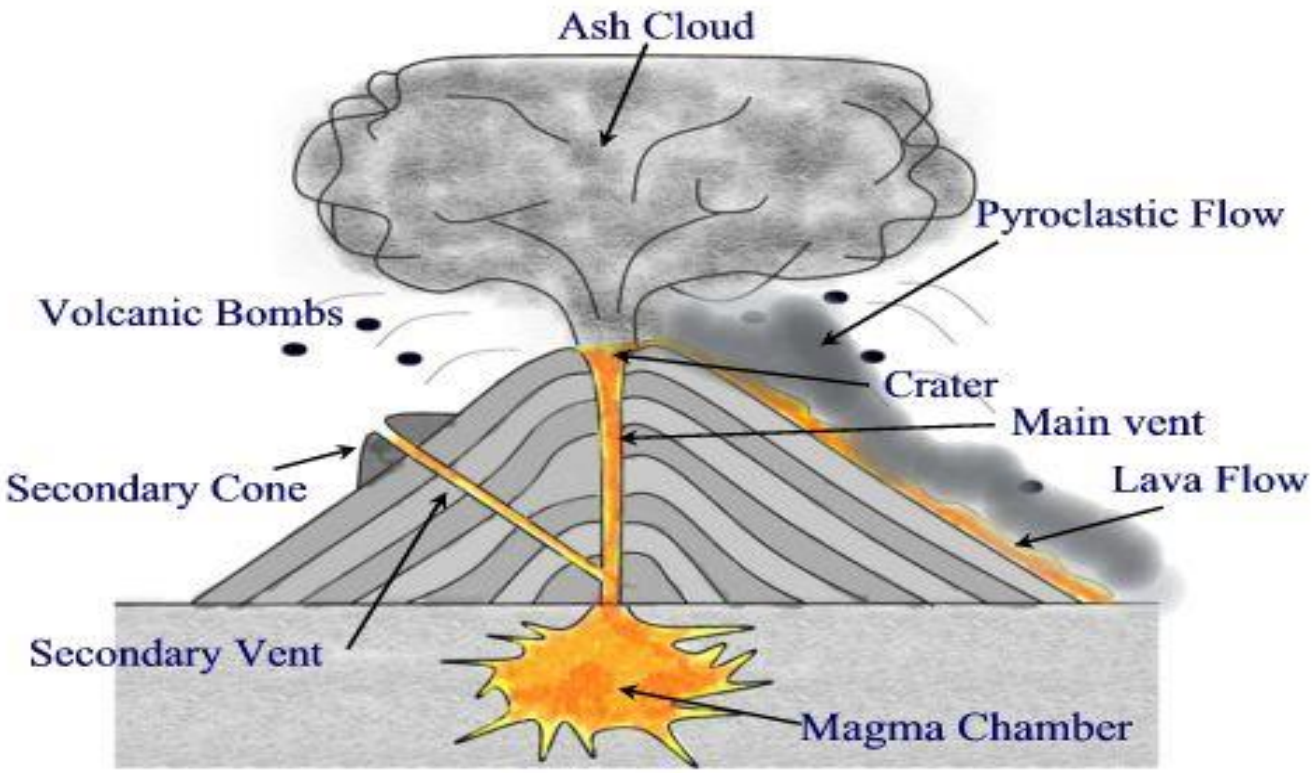
- The positives of volcanoes
  - -New Land is formed
  - -Release of healthy gases
  - -Many gems and ores worth $
  - -Hominids used obsidian (cutting tools) to advance
  - -Volcanic ash fertilizes land
  - -Volcanic eruptions formed oceans and early atmosphere.
  - -Tourism

Types of Volcanoes

Fissure
Shield – Olympus Mons on Mars Ex.
Dome
Ash Cinder
Composite

Caldera: Large crater caused by the violent explosion of a volcano that collapses into a depression.

PARTS OF A VOLCANO



Main Features of a Volcano

Pyroclastic rock: Rock ejected from volcano
Lahar - A flow of volcanic ash and water.

Magma is beneath the earths surface
Lava is above the surface

3 Types of Lava

Felsic lava – High in silica. (sticky and chunky) Highly explosive.
Mafic lava – Flows more, high in basalt.
Intermediate – Has a higher amount of silica (Silica = liquid quartz or sand)

Viscosity: Resistance of liquid to flow.

High viscosity = Travels slow because of high resistance
Low viscosity = travels fast because low resistance

Types of lava when cooled

'A'ā - Rough lava, older and has crystalized, Pronounced "ahh ahh"

Pāhoehoe – Fresh lava, (Pa hoy hoy) Basaltic lava that is smooth and flowing.

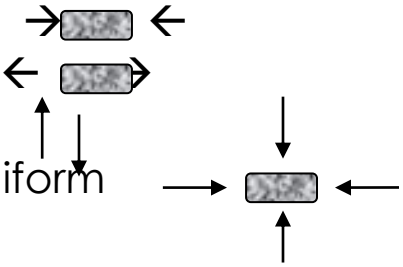
New Area of Focus: Faults and Folds.

Orogeny: The formation of mountain ranges by intense upward displacement of the earth's crust.

- Usually associated with folding, thrust faulting, and other compressional processes.

Movement of tectonic plates against each other causes the plates to fault and fold.

- Stress on a rock can be…
  - Compression
  - Tension
  - Shearing
  - Confining / Uniform

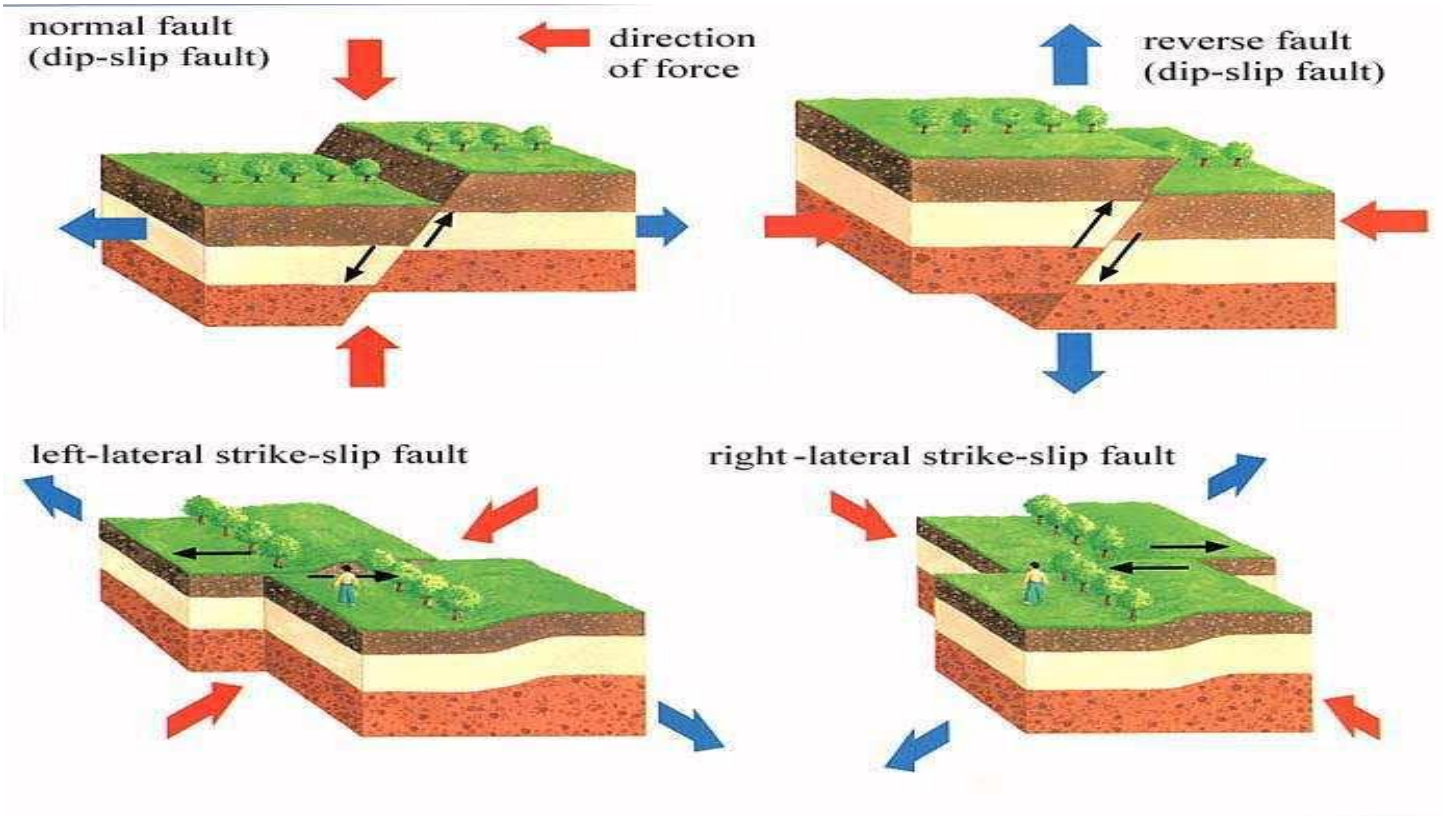


- Fault – Break / crack where movement occurs.
- Fold – Collision of crust bends rock layers "stress"

Normal Fault – Pulling a part tension causes crust to drop down.

Reverse / Thrust Fault – Compression forces cause crust to move up.

Lateral or Strike Slip Fault –Crust moves alongside each other in opposite directions.



Types of Folds

- Compression
  - Anticline: ☹ Oldest layer is at core of fold (Oil)
  - Syncline: ☺ Youngest later is at core of fold (Water)
- Tension
- Shearing

Earthquake – Shaking of the earth's crust from a sudden release of energy.

Seismograph - An instrument used to measure the shaking caused by an earthquake

Richter Scale - Scale for measuring earthquake magnitude. A magnitude 7.0 earthquake generates 10 times larger amplitude waves than those of a magnitude 6.0.

Epicenter: The point on the Earth's surface that is directly above the hypocenter or focus.

- Just above the earthquake.

Tsunami - An ocean wave generated by a submarine earthquake, volcano or landslide.

- Can travel across whole oceans.

ROCKS AND MINERALS

Rock – Mass or grouping of minerals

They can be big
They can be small
Used in buildings
Inorganic (non-living)

Minerals are natural inorganic (non-living) solids that join together (crystals) to make unique compositions.

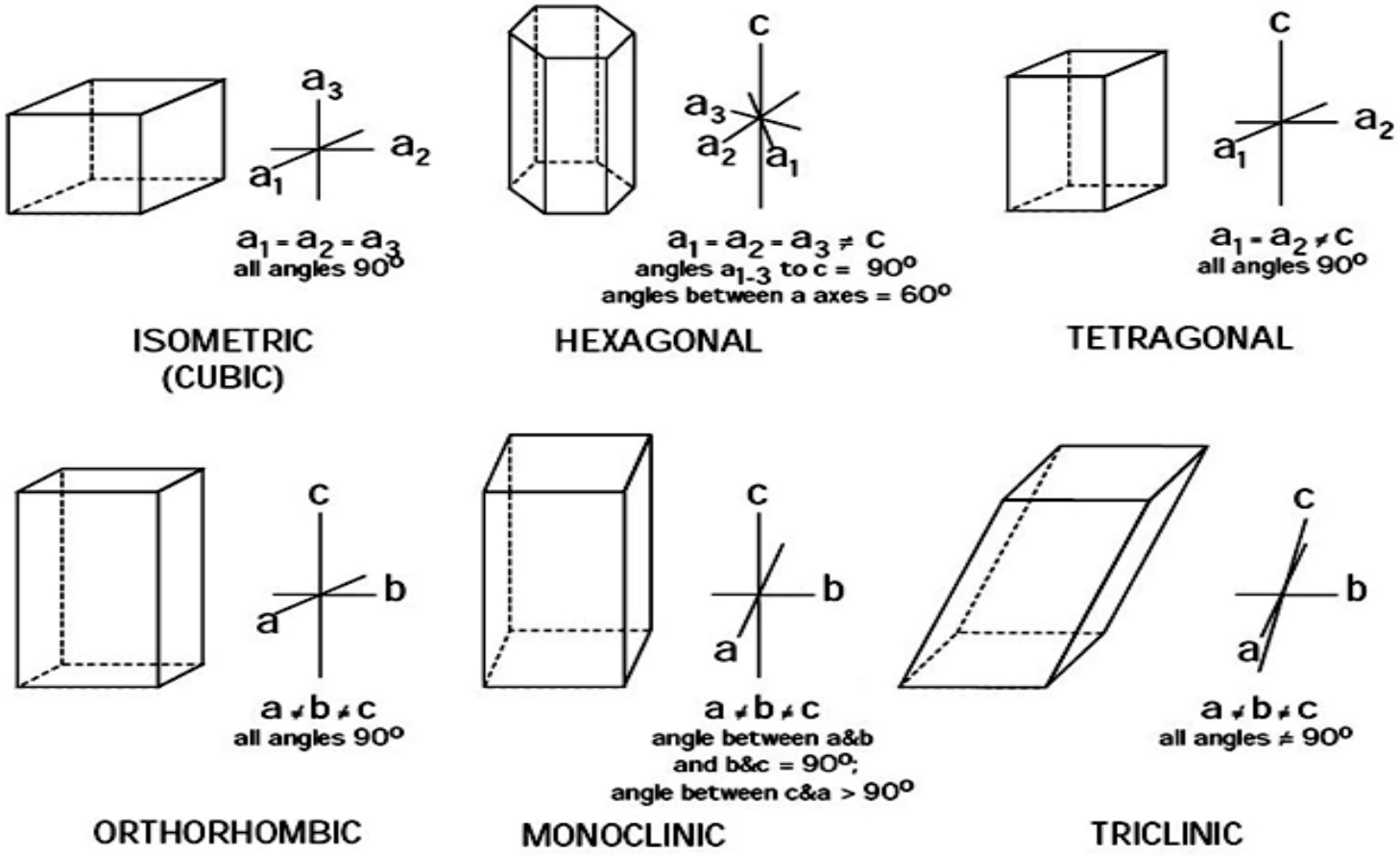
A crystal is a solid in which the atoms arranged in a repeating pattern.

Uses of minerals

Gems $
Ores, Mined for $

Types of crystals.

- Hexagonal. (Four axes, three are equal in length and lie at an angle of 120° from each other).
- Triclinic: (3 axis, all unequal and none at 90° angles).
- Orthorhombic: (All axis unequal in length, and 90° degrees from each other).
- Monoclinic:All axis unequal in length. Two of them are at right angles to each other, while the third is lies at an angle other than 90°.
- Tetragonal. (Three axes, two are equal in length, one is unequal.)
- Isometric: (All three axes are equal in length an at 90° degrees from each other.)



Crystal Properties / Chemical Bonds

- **Covalent Crystals**: Covalent bonds between all of the atoms.
  Example: Diamond, Zinc Sulfide crystals.
- **Metallic Crystals**: Individual metal atoms of metallic crystals sit on lattice sites.
  - Many free electrons. High melting points.
- **Ionic Crystals**: The atoms are held together by electrostatic forces (ionic bonds).
  - Ex: (NaCl) table salt
- **Molecular Crystals**: Contains recognizable molecules within their structures.
  - Held together by non-covalent interactions, like van der Waals forces or hydrogen bonding.
    - Example – Sucrose in rock candy, ice cube

- Two main types of minerals

  Silicate Minerals – Contain silica and oxygen. 75% of all minerals.
  Non-silicate minerals

  Non-silicate minerals: All others.

Physical Property of Minerals- a characteristic that can be observed or measured without changing the identity of the substance.

Luster – How light is reflected from a mineral.

- Metallic (shiny)
- or non-metallic (dull)

Hardness – How easily a mineral can be scratched.

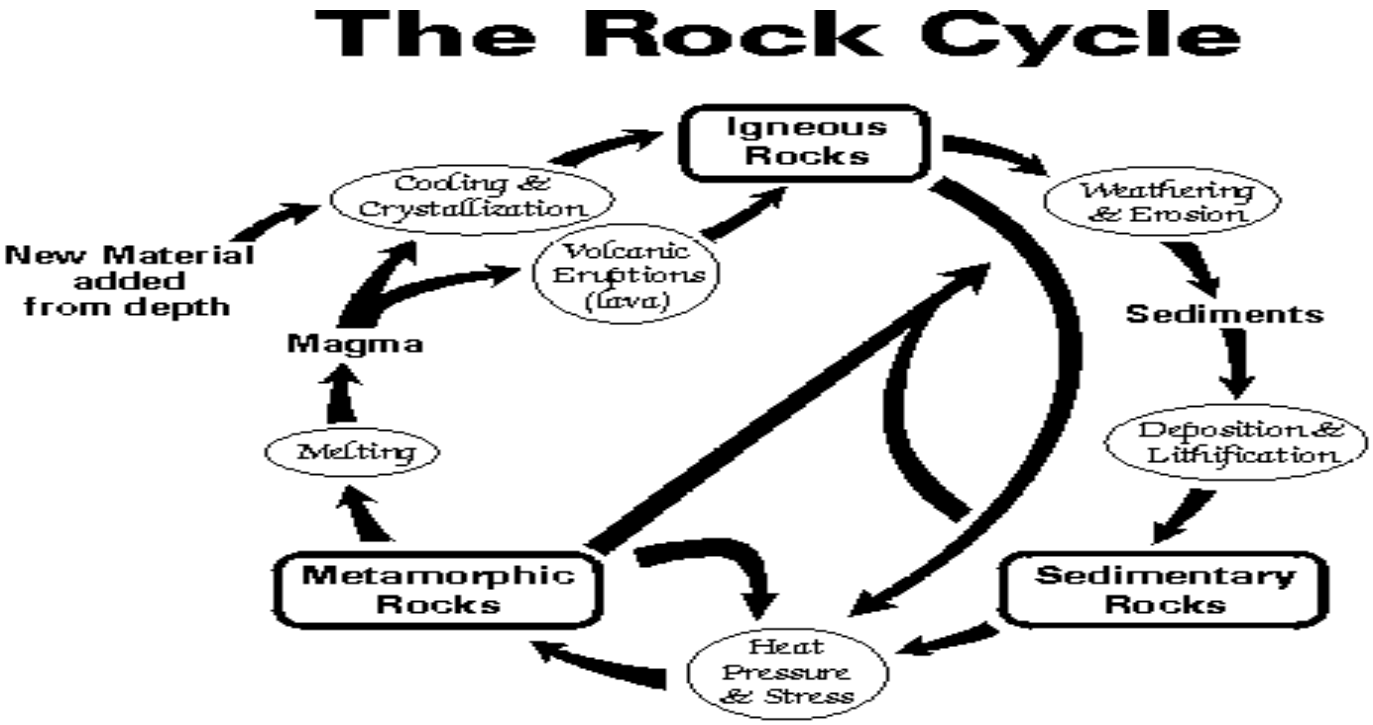
Color – Tells what atoms make up the mineral.

Streak – The color of the mineral when it is broken up and powdered

Specific Gravity – How dense the mineral is?

The rock cycle – How one rocks changes into another.

- Driven by continental drift (plate tectonics)



Igneous Rocks: Molten Earth cooled.

- Intrusive – Cooled below crust (slow)
  - Larger crystals
- Extrusive – Cooled on Earth's surface (faster).
  - Fine grain crystals or no crystals.

- Igneous rocks
  - Mafic (Darker in color) is used for silicate minerals, magmas, and rocks which are relatively high in the heavier elements. (Magnesium and Iron)
  - Felsic (Lighter in color) is used for silicate minerals, magmas, and rocks which have a lower percentage of the heavier elements. Have more of the lighter elements. (Silicon and oxygen, aluminum, and potassium) Feldspar

Classification of Igneous Rocks

Basaltic – Dark, heavy (dense), Iron
Granitic – Light colored, less heavy, filled with oxygen
Andesitic – Between the two

Common Igneous Rocks

Granite is Igneous Rock types include Quartz and feldspar
Basalt
Obsidian – Glassy
Gabbro
Rhyolite

Metamorphic – Rock that changed forms due to extreme temperature and pressure

Common Metamorphic Rocks

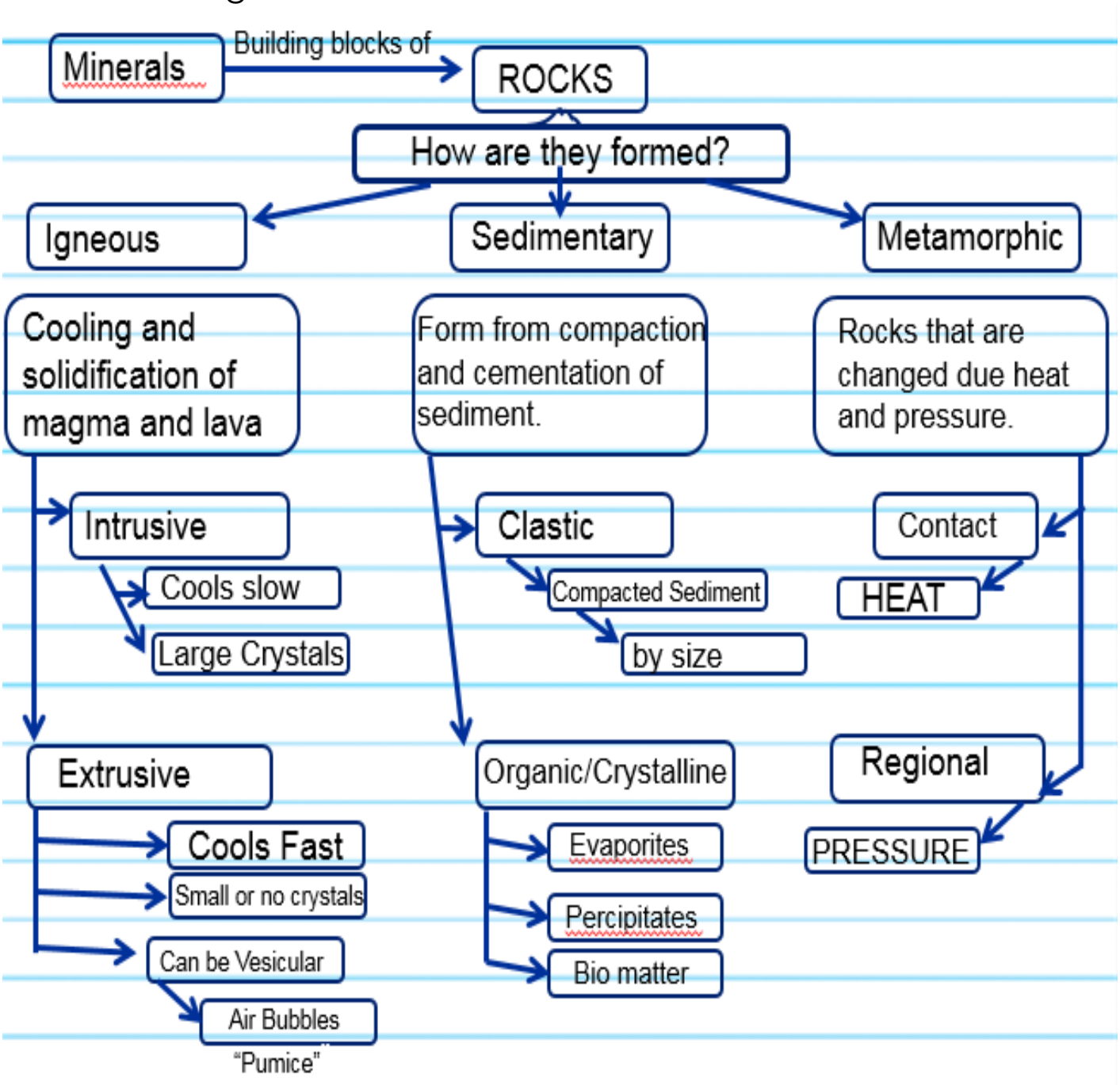
Slate
Gniess
Marble
Schist

Sedimentary Rocks

Sediments are compacted and cemented together

Caused by weathering, erosion, and deposition
Usually layered
Layers can be from old living materials (fossils).

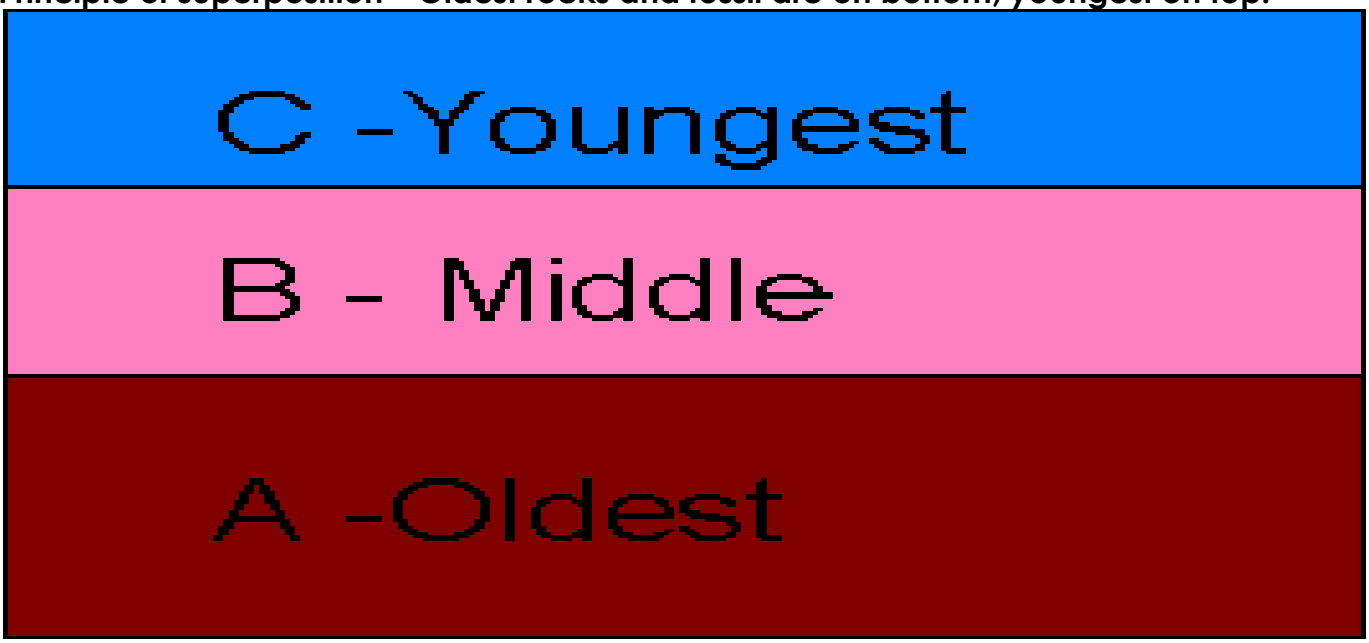
Common Sedimentary Rocks
- Limestone
- Sandstone
- Shale
- Conglomerate

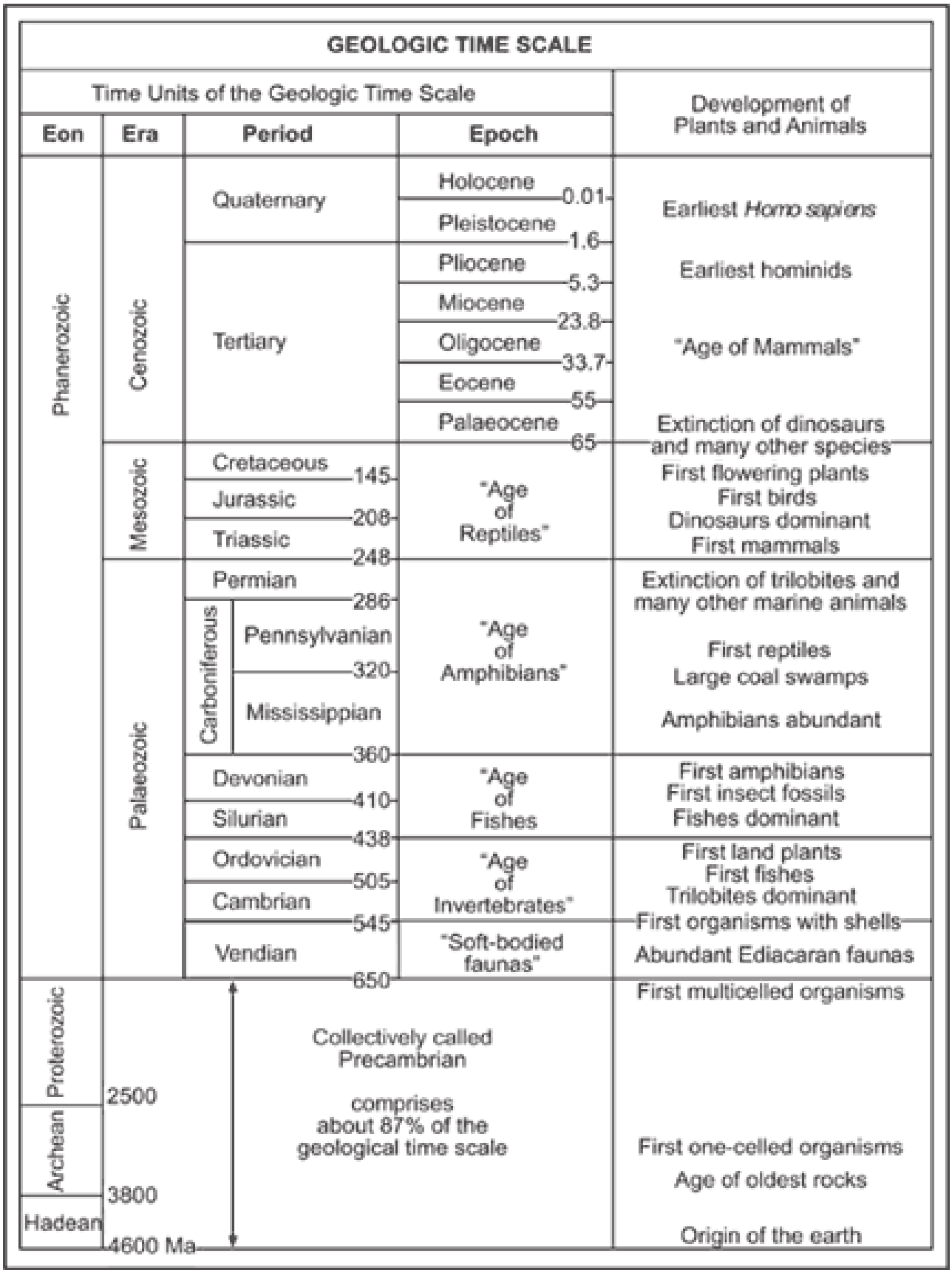


Earth System History

Earth History Components

- Earth system history has physical, chemical, and biological components
- Uniformitarianism: Laws of nature have not changed over time.
- The system is fragile. Changes in living conditions for animals have been numerous throughout earth's history.
- 99.5% of all things that have ever lived have become extinct.

- **Principle of superposition – Oldest rocks and fossil are on bottom, youngest on top.**
- 


GEOLOGIC TIME SCALE
Time Units of the Geologic Time Scale
Development of Plants and Animals
Eon
Era
Period
Epoch
Phanerozoic
Cenozoic
Quaternary
Holocene
0.01
Pleistocene
1.6
Earliest Homo sapiens
Tertiary
Pliocene
5.3
Earliest hominids
Miocene
23.8
Oligocene
33.7
"Age of Mammals"
Eocene
55
Palaeocene
65
Extinction of dinosaurs and many other species
Mesozoic
Cretaceous
145
Jurassic
208
Triassic
248
"Age of Reptiles"
First flowering plants
First birds
Dinosaurs dominant
First mammals
Palaeozoic
Permian
286
Extinction of trilobites and many other marine animals
Carboniferous
Pennsylvanian
320
Mississippian
360
"Age of Amphibians"
First reptiles
Large coal swamps
Amphibians abundant
Devonian
410
Silurian
438
"Age of Fishes"
First amphibians
First insect fossils
Fishes dominant
Ordovician
505
Cambrian
545
"Age of Invertebrates"
First land plants
First fishes
Trilobites dominant
First organisms with shells
Vendian
650
"Soft-bodied faunas"
Abundant Ediacaran faunas
Proterozoic
2500
First multicelled organisms
Archean
3800
First one-celled organisms
Age of oldest rocks
Hadean
4600 Ma
Origin of the earth
Collectively called Precambrian
comprises about 87% of the geological time scale

Precambrian

Hadean, Archean, and Proterozoic Eon's

Earth's Molten layers form (Denser to middle)
Formation of Earth's Crust (cooling).

- Meteorites bombard the planet and carry with it water molecules and amino acids (building blocks of protein).
-

Moon created from comet impact

Atmosphere originates (No oxygen yet)

Earliest life begins (primitive protocells)

- Microbes helped produce an oxygen atmosphere through photosynthesis.

First Multi-cellular life (many cells)
Explosion of new animals (sea)

Paleozoic Era

Vendian, Cambrian, Ordovican, Silurian, Devonian, Carboniferous, and Permian Periods.

Marine invertebrates dominate
Jawed Fish Evolve
Plants invade land (Oxygen to atmosphere)
Insects emerge
First Amphibian
First Reptiles
First winged insect

Mesozoic Era

Triassic, Jurassic, Cretaceous Periods

Dinosaurs dominate
First Birds

First Mammals
First Flowers
K-T Mass Extinction Event, 65mya

Cenozoic Era

Tertiary, and Quaternary Periods

Mammals change
Earliest Monkeys
Climate becomes drier
Panama attaches South America to North America
First human hominids
Modern Man (Whoa)
Civilization
Age of Exploration, Industrial and Computer Age

SAVE THESE NOTES FOR THE ASSESSMENT

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