# Warm Up #1

- How is coal formed?
- Where in the world is most of our coal found? Describe the environmental conditions of this place.
- How does the law of supply and demand work [give 1-2 sentence summary]?
- Did you see Project X? Was it as lame and plot-less as the previews indicated?

# Chapters 5 and 14

## Mineral and Soil Resources

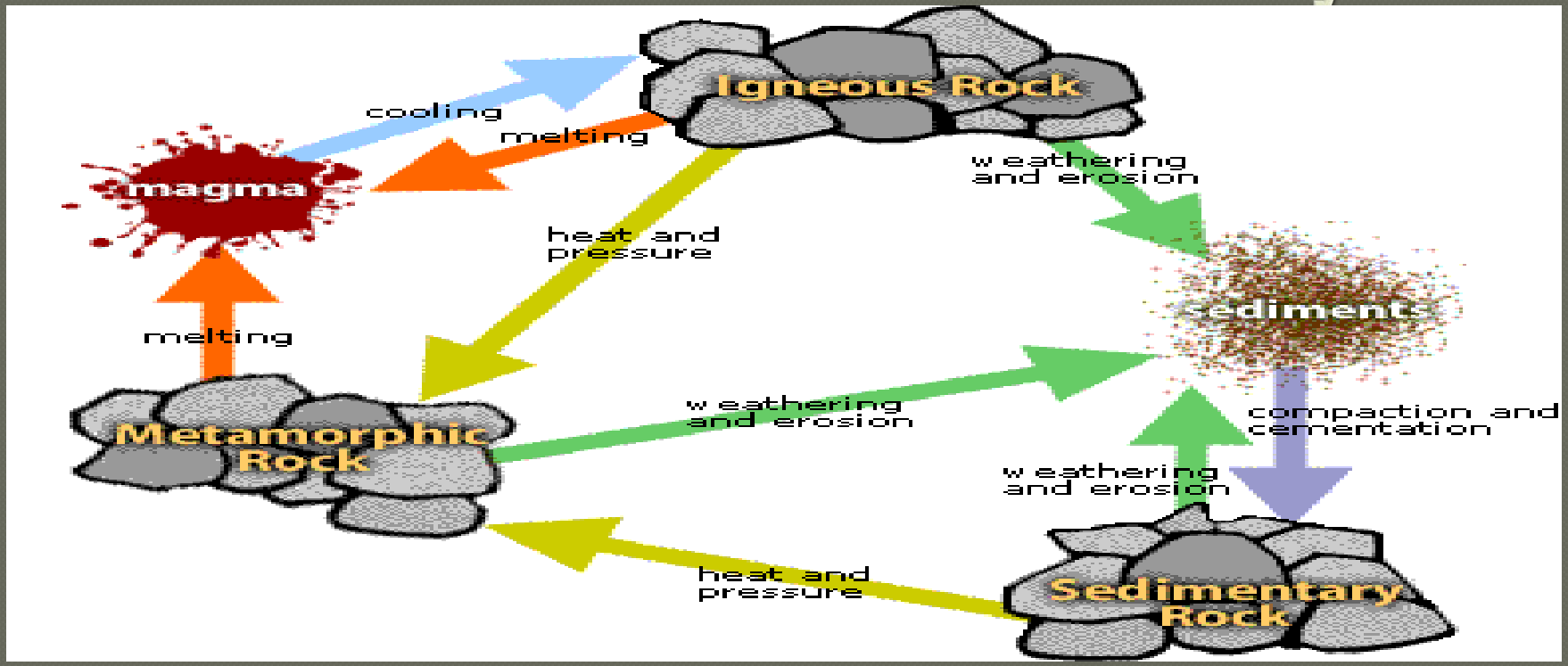
# Geology & Layers of Earth

- Geology – study of rocks
  - Rock formation, changes, cycles

Layers of Earth *(inner to outer)*

1. Inner Core – iron, solid (HIGH pressure)
2. Outer Core – iron, molten (HIGH pressure)
3. Mantle – iron & silicon;  solid - thickest
4. Crust -  silicon (sand) - thinnest

# The Rock Cycle



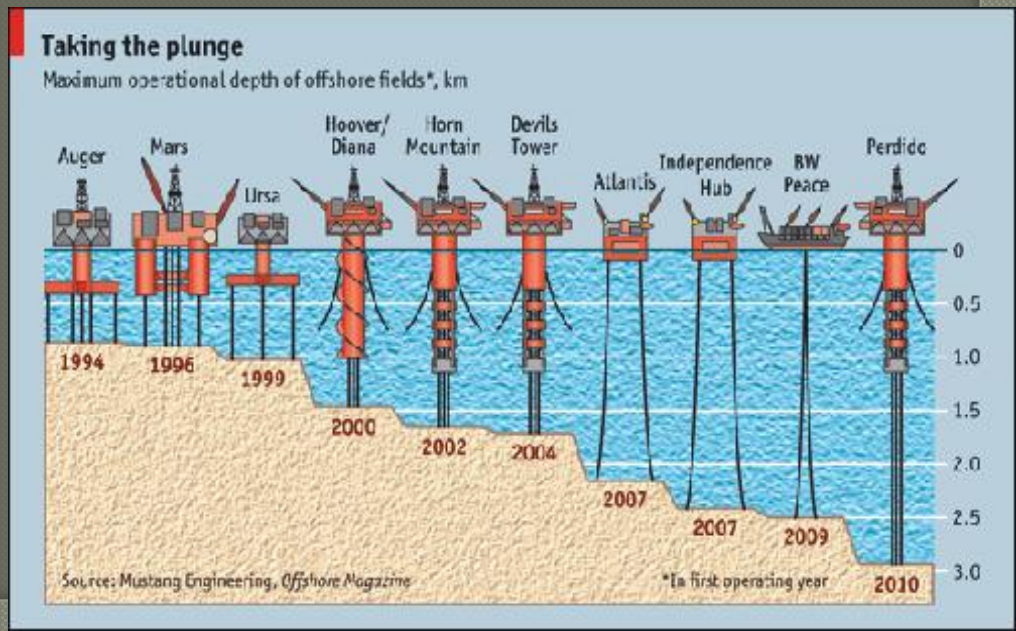

**Igneous Rock** – formed as magma (molten rock) cools and rises up

**Sedimentary Rock** – formed via erosion of various rocks, coming together in water

**Metamorphic Rock** – formed from heat and pressure of pre-existing rocks

# Mineral Resources

- **Mineral Resource** – material that can be extracted & used economically
  - **Ore** – metal-material
- Economical vs. Not Economical?
  - Profits > Costs
  - Drilling for oil in Gulf?



# Coal

- **Coal** – metamorphic rock formed by dead vegetation in swampy biomes
  - High heat and pressure

Obtained via MINING

- **Surface** – shallow (60%)
- **Open-Pit** – drill holes to remove ore
- **Strip** – remove rock/soil in strips on surface

# Sub-Surface Mining: Coal

- **Sub-Surface Mining** – deep vertical shaft dug. Walls blasted, coal extracted
  - Pros – less land disturbed, less waste (spoil)
  - Cons – dangerous, expensive

100TH ANNIVERSARY — ALWAYS AMERICA FIRST

Chicago Daily Tribune — THE WORLD'S GREATEST NEWSPAPER — 42 PAGES — CITY ★★★ FINAL

VOLUME CVI.—NO. 73 C — WEDNESDAY, MARCH 26, 1947 — FOUR CENTS—PAY NO MORE

# 73 IN MINE! 23 DEAD

## *Explosion Rips Illinois Pit; 1st Survivor's Story*

**SENATORS ACT TO ABOLISH LILIENTHAL JOB**

Would Give Post to Marshall

BY WILLIAM MOORE

**Call for Global Slant in U. S. School Books**

BY ROBERT YOUNG

**ADMITS GREEK 'CRISIS' KNOWN 5 MONTHS AGO**

Told of British Plan Last Fall: Acheson

BY WILLARD EDWARDS

THE FRONT MAN




**House Votes NLRB Slash, Fires Warren**

BY JOHN FISHER

**RESCUE CREW BATTLES GAS 540 FEET DOWN**

Help Rushed to Disaster Scene

Centralia, Ill., March 26—(Wednesday)—(Special)—Masked rescue workers early today fought their way along

# Miner's Canary

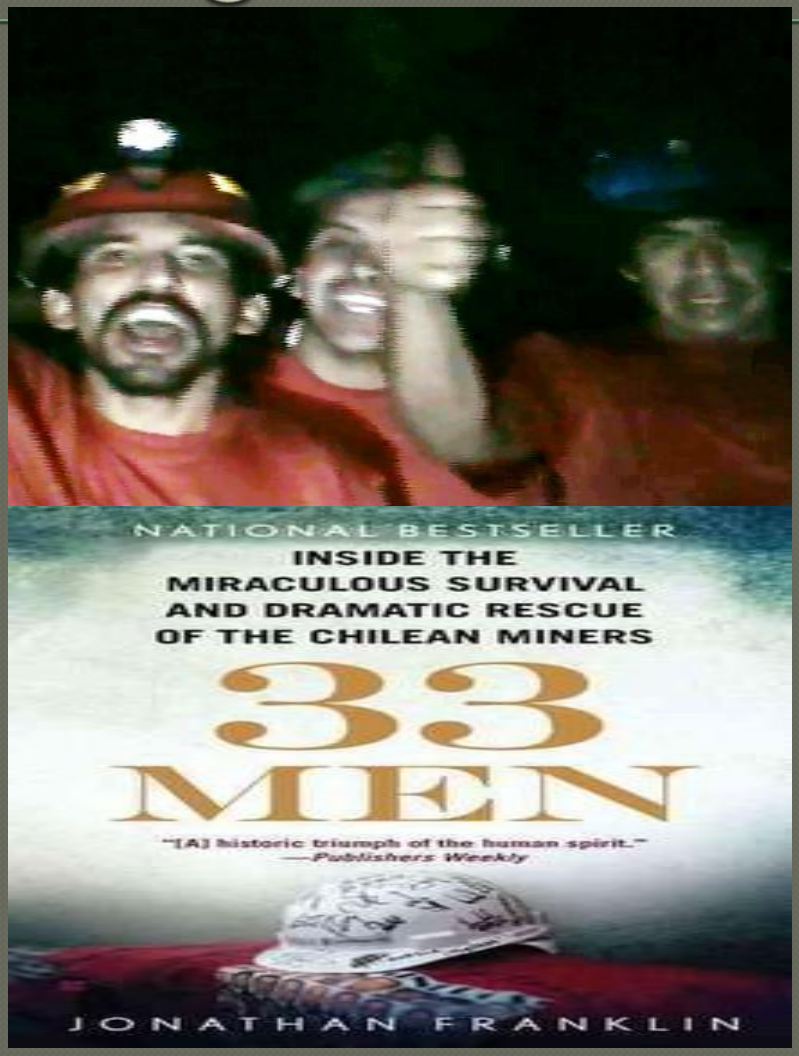
- Sent into mines to detect safety
- Carbon monoxide, methane detector
- If bird is chirping, it is safe. If not, it's dead. Sorry about it.
- Phased out in 1980's

# Environmental Effects of Mining

- Land disturbed
- Noise and health problems
- Contaminated groundwater (sulfuric acid)
- Methane – greenhouse gas

# Chilean Mining Accident

- August 5th, 2010 – mine collapses
- Copper/gold mine
- 33 miners, 69 days
- Sex, drugs, PTSD



# Quick Quiz #1

- What are the three major types of rocks in the rock cycle?
- How can coal negatively impact the environment (3 reasons).
- Name three ways that we can excavate coal?

# Econ. 101 & Coal Mining

- Supply and Demand
  - Supply > demand = cheap
- Foreign dependency (Japan)
- Mining costs = low
  - Mining does NOT include environmental costs (paid by taxpayers)

# Warm Up #2

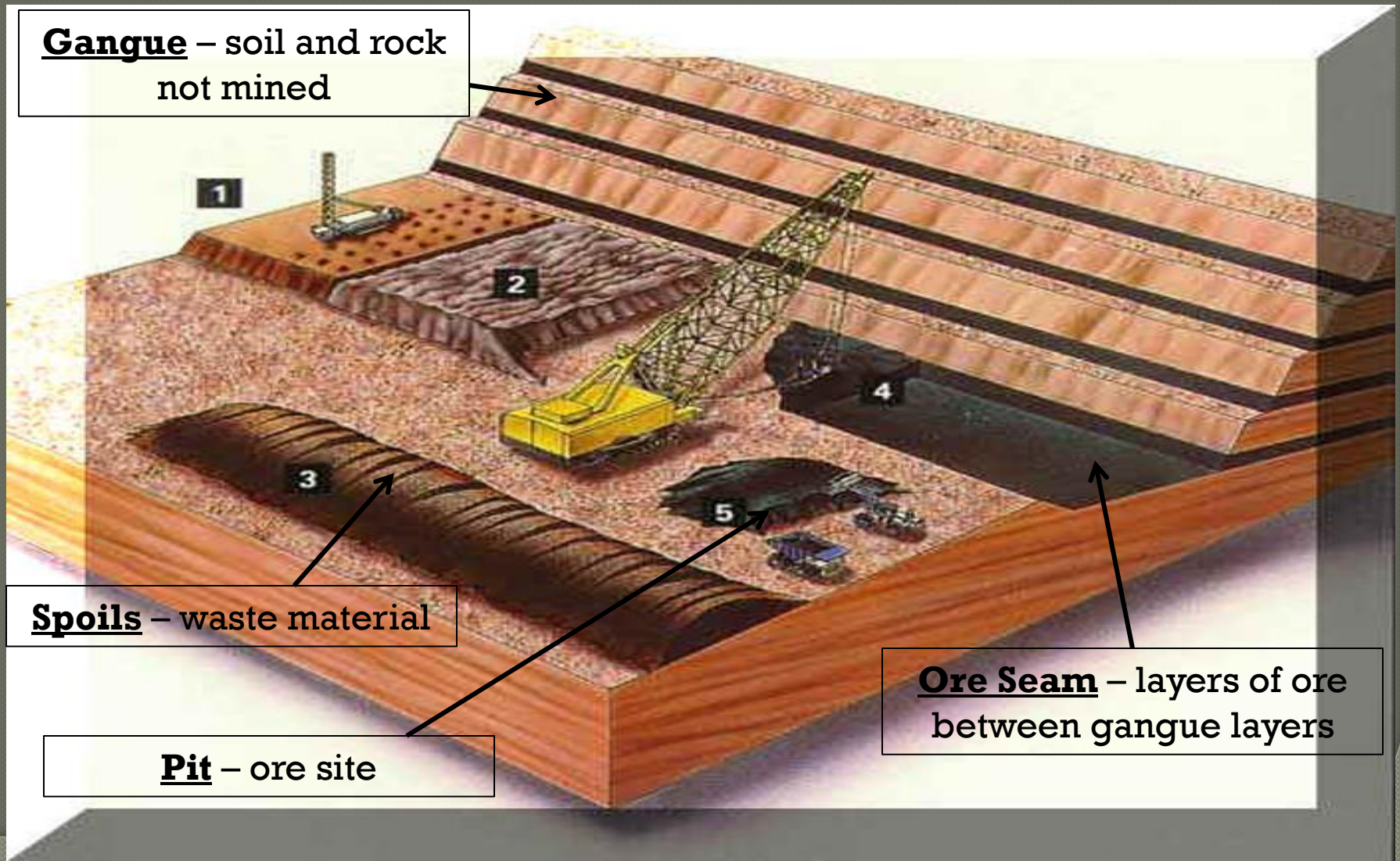
- What is the non-chocolate chip part of the cookie representing in your lab?
- Why is it important to restore and preserve your cookie as much as possible, when applying this to real life?
- After Day 1, do you think you will use a different cookie today? Why or why not?

# Warm Up #3

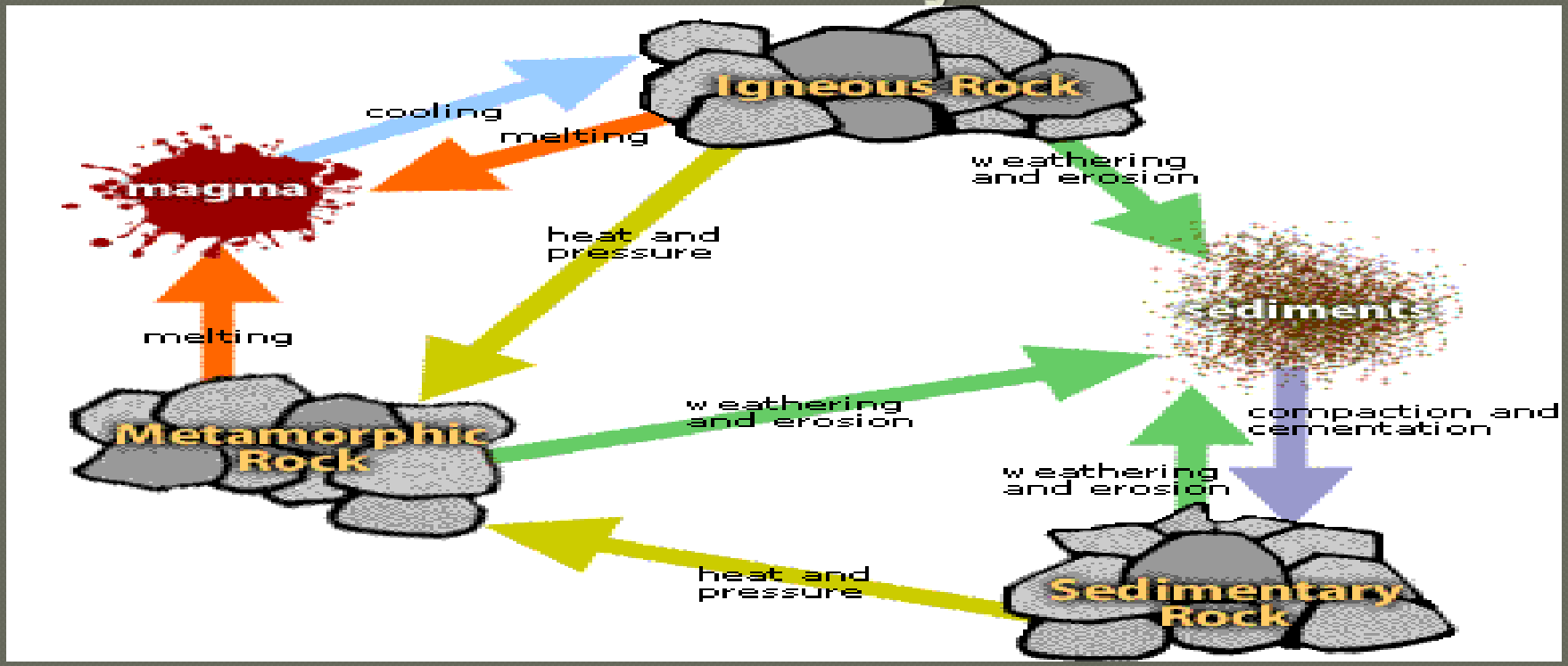
- Why do Earthquakes happen?
- How do mountains form?

# Plate Tectonics

# Cookie Mining Pictured



# The Rock Cycle Review




**Igneous Rock** – formed as magma (molten rock) cools and rises up

**Sedimentary Rock** – formed via erosion of various rocks, coming together in water

**Metamorphic Rock** – formed from heat and pressure of pre-existing rocks

# How are Rocks Shifting?

- **Plate Tectonics** – movement of giant rock plates
  - Earthquakes, volcanoes, trenches, mountains, etc.

3 Types

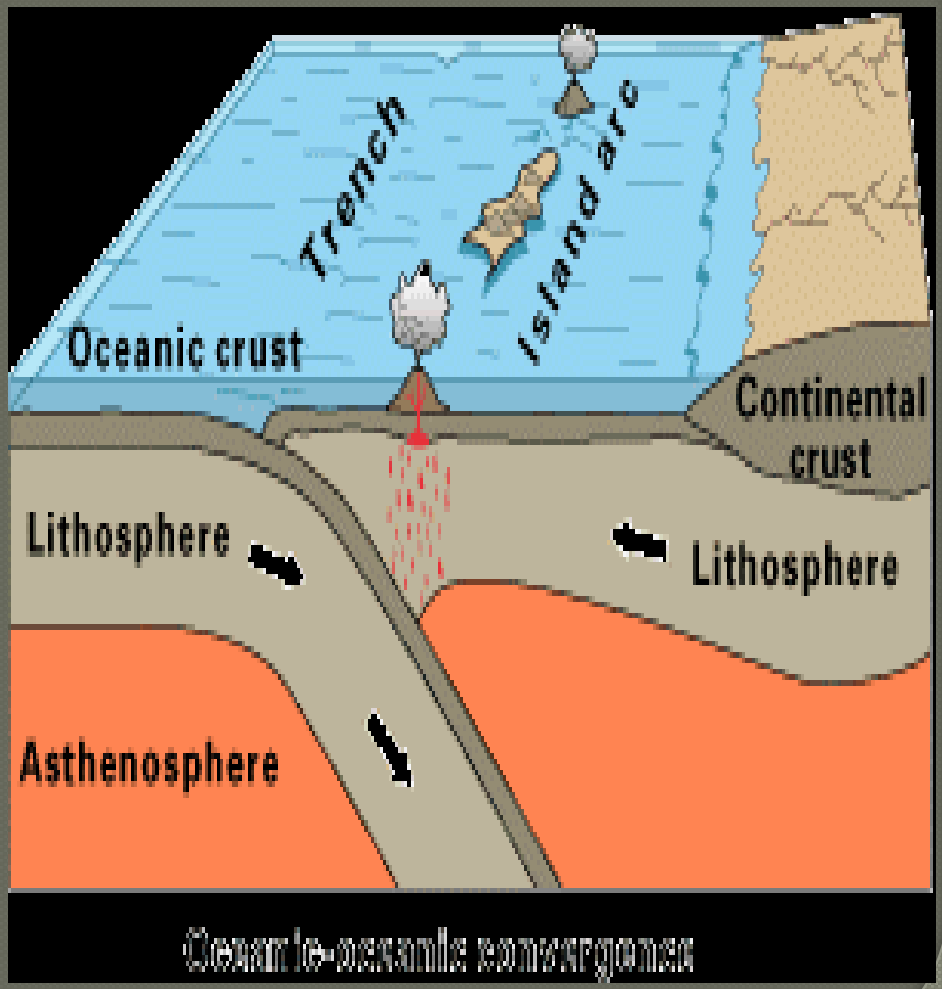
- **Convergent** – two plates move TOWARD each other
- **Divergent** – two plates move AWAY from each other
- **Transform** – two plates rub against each other in opposite directions

# Where this is Happening

- *Review: Core, Mantle, Crust*

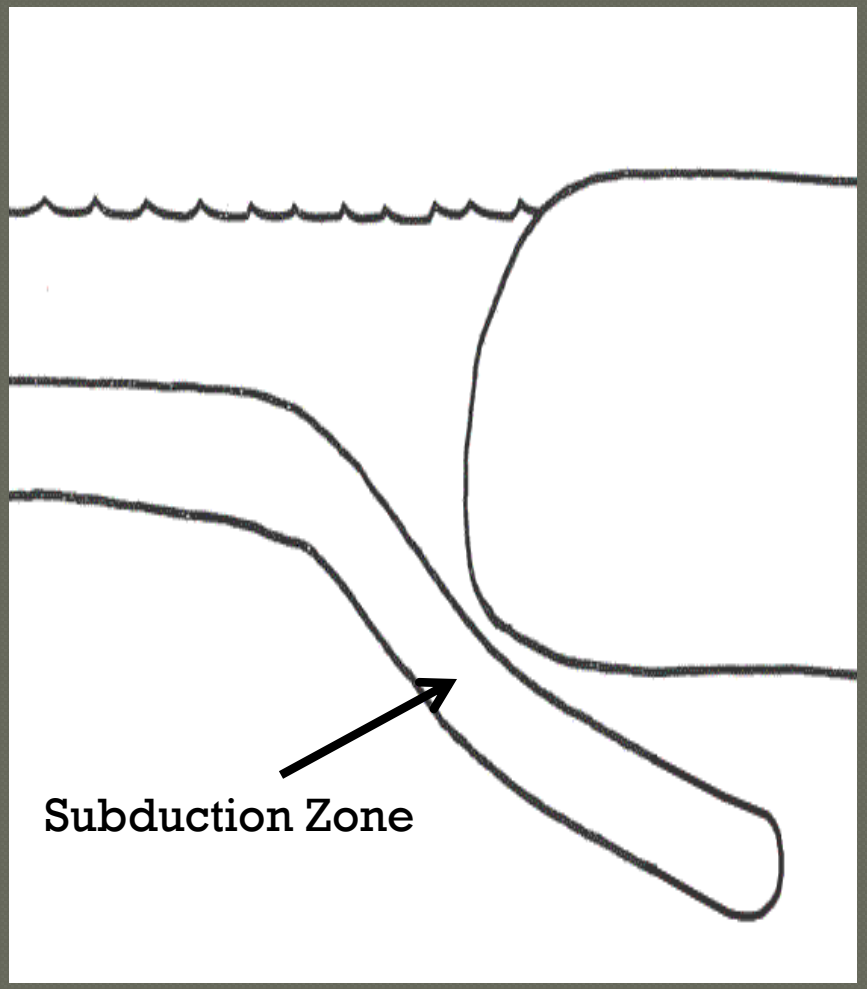
In Mantle, two layers:

- **Lithosphere** – top part of mantle
  - Tectonic plates that move
- **Asthenosphere** – bottom part of mantle
  - Where magma is found



# How Convergent Plates Work

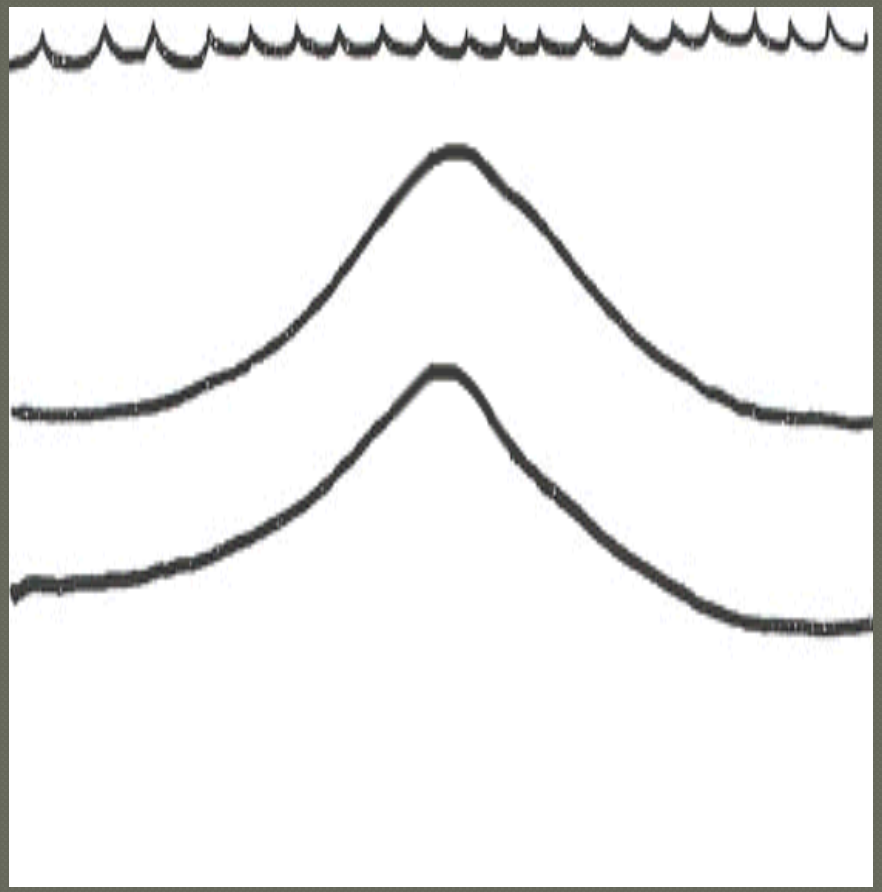
- Plates come together
- One moves downward (**Subduction Zone**)
  - Trench forms
- Magma pushed up
  - Volcanic eruption
- Earthquakes



# Result: Volcanoes

# How Divergent Plates Work

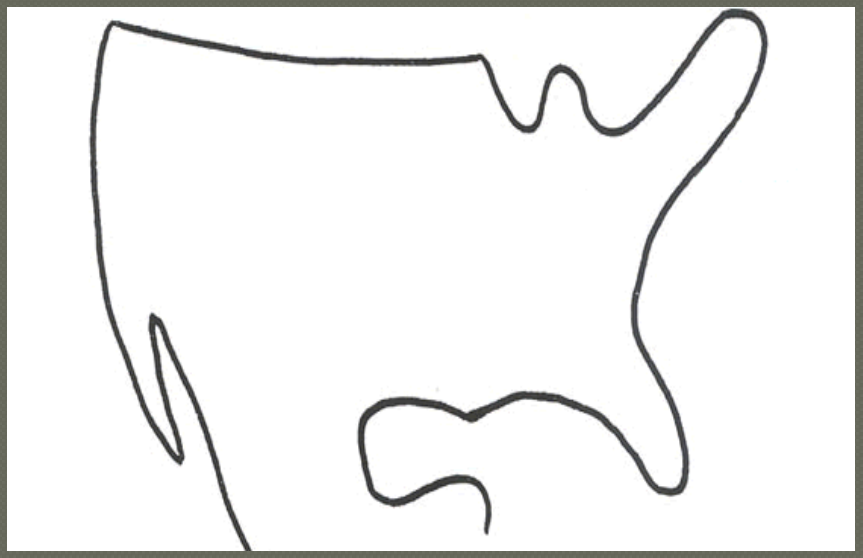
- Plates move away
- Magma flows in to **fissure** (hole between plates) and cools
- Forms OCEANIC RIDGES

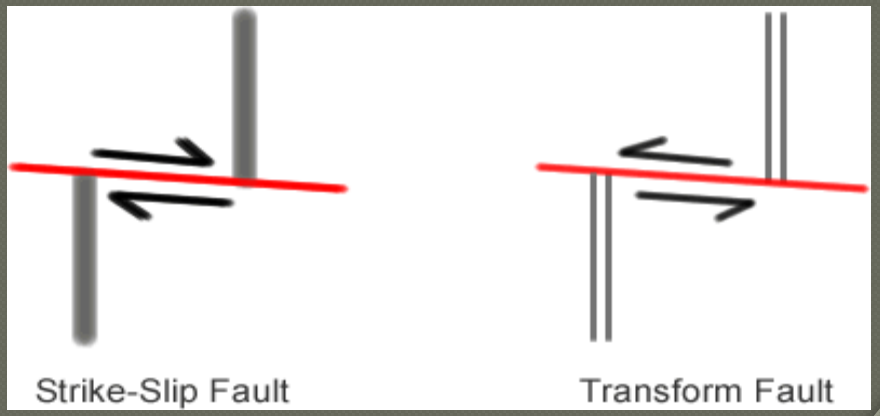


# Oceanic Ridges & Rift Valleys

# How Transform Plates Work: LA

- Rub against each other
  - **Fracture Zone**
- Similar to convergent
  - No sinking
- Strike-strip & transform faults
- Earthquakes triggered
- Ex. San Andreas Fault



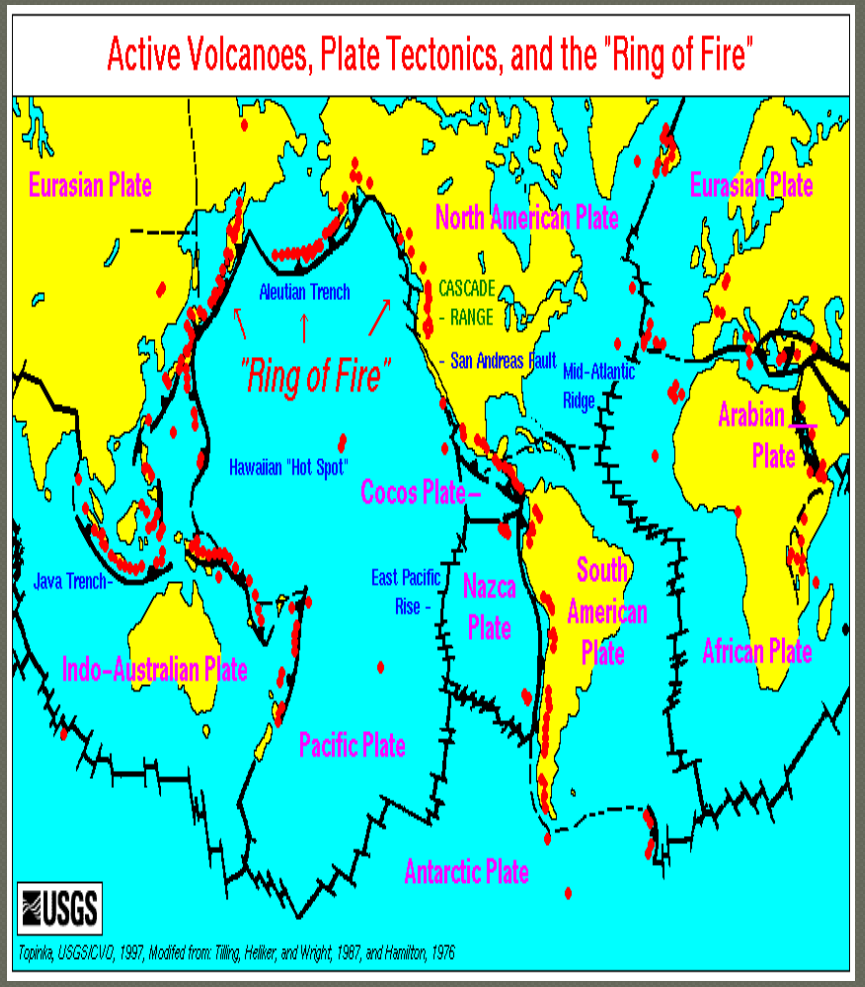


# Will We Be an Island?

- San Andreas Fault:
  - CA = Pacific Plate
  - AZ = North American Plate
- CA shifting northeast
- AZ shifting southwest
  - 33mm/year
- In 100,000+ years:
  - CA = in Oregon/Wash.
    - Hipsters….

# Volcano/Earthquake Connection

- Ring of Fire – Pacific Ocean



# Warm Up #4

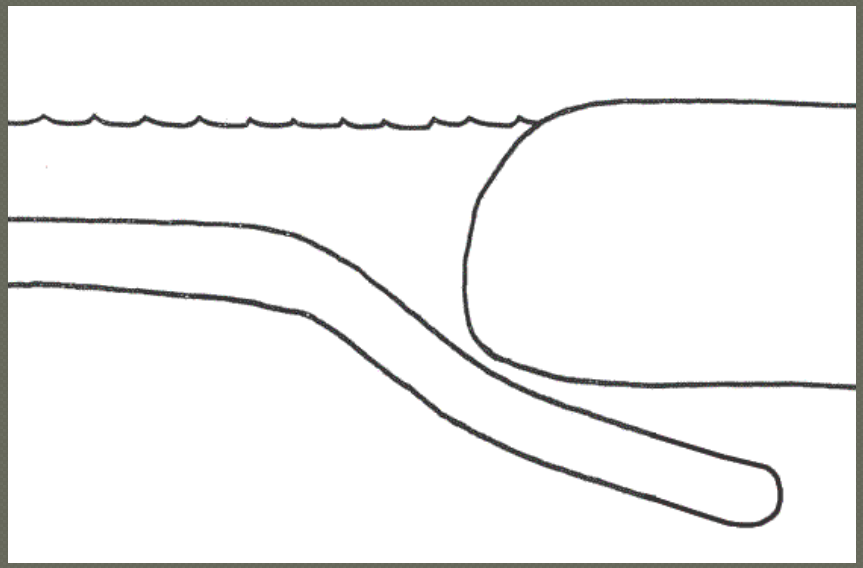
- How does a convergent plate boundary work?
- Describe how magma is pushed upward, causing a volcano to erupt.
- Which type of volcano is worse, an active or a dormant volcano? Why?

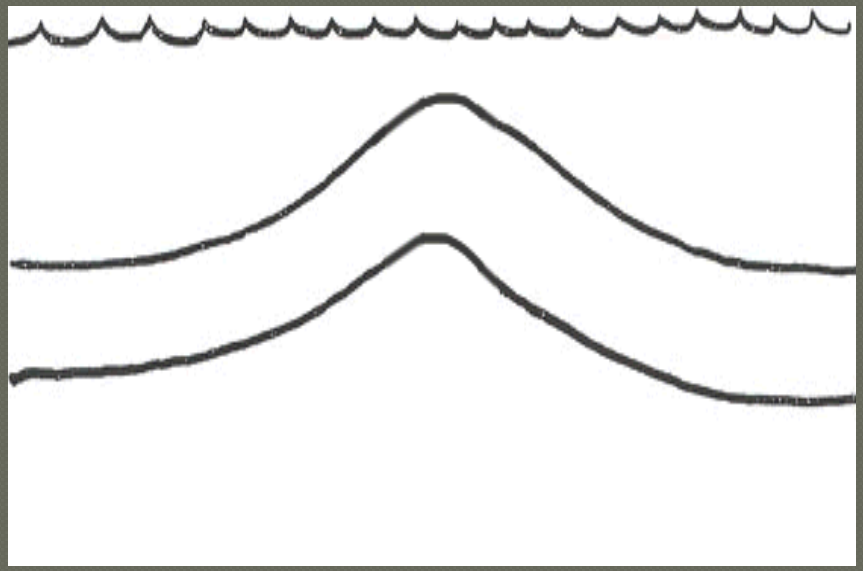
# Volcanoes

# Rock Cycle Review: Part III

- **Igneous** – magma cooling (granite, basalt)
  - Majority of rocks on EARTH
- **Metamorphic** – heat and pressure (coal)
- **Sedimentary** – sediment (particles) compacting
  - Majority of rocks on Earth's SURFACE
  - FOSSILS found in these

# Convergent vs. Divergent



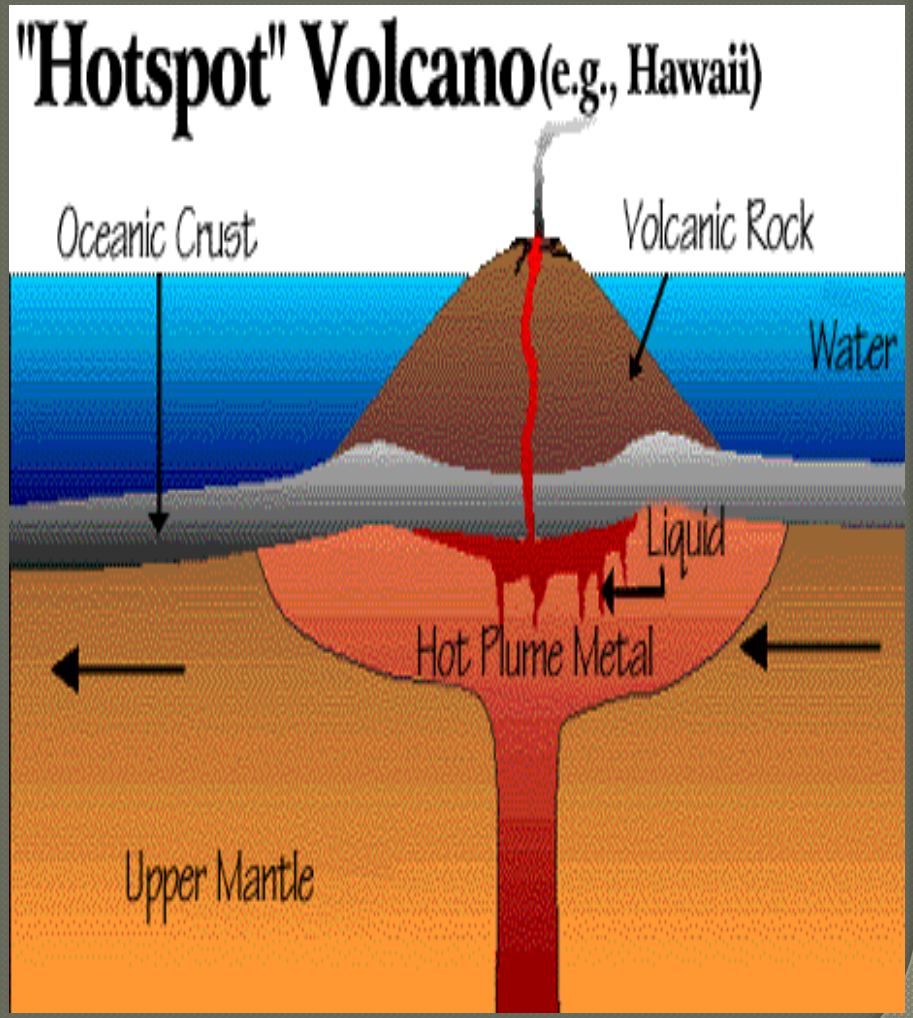


- **<u>Convergent</u>** – two plates push together (make mountains)
- Subduction Zone
- Pressure pushes up magma → volcanoes

- **<u>Divergent</u>**– two plates push away from each other
- Fissure
- Magma cooling → oceanic ridges and rift valleys

# Volcanoes

- 95% = subduction zones & fissures
- 5% = "**hot spots**" – magma close to surface
- *Produce*: magma, **pyroclastic particles** (ash), toxic gases (sulfur-based)



# Sulfur Cycle

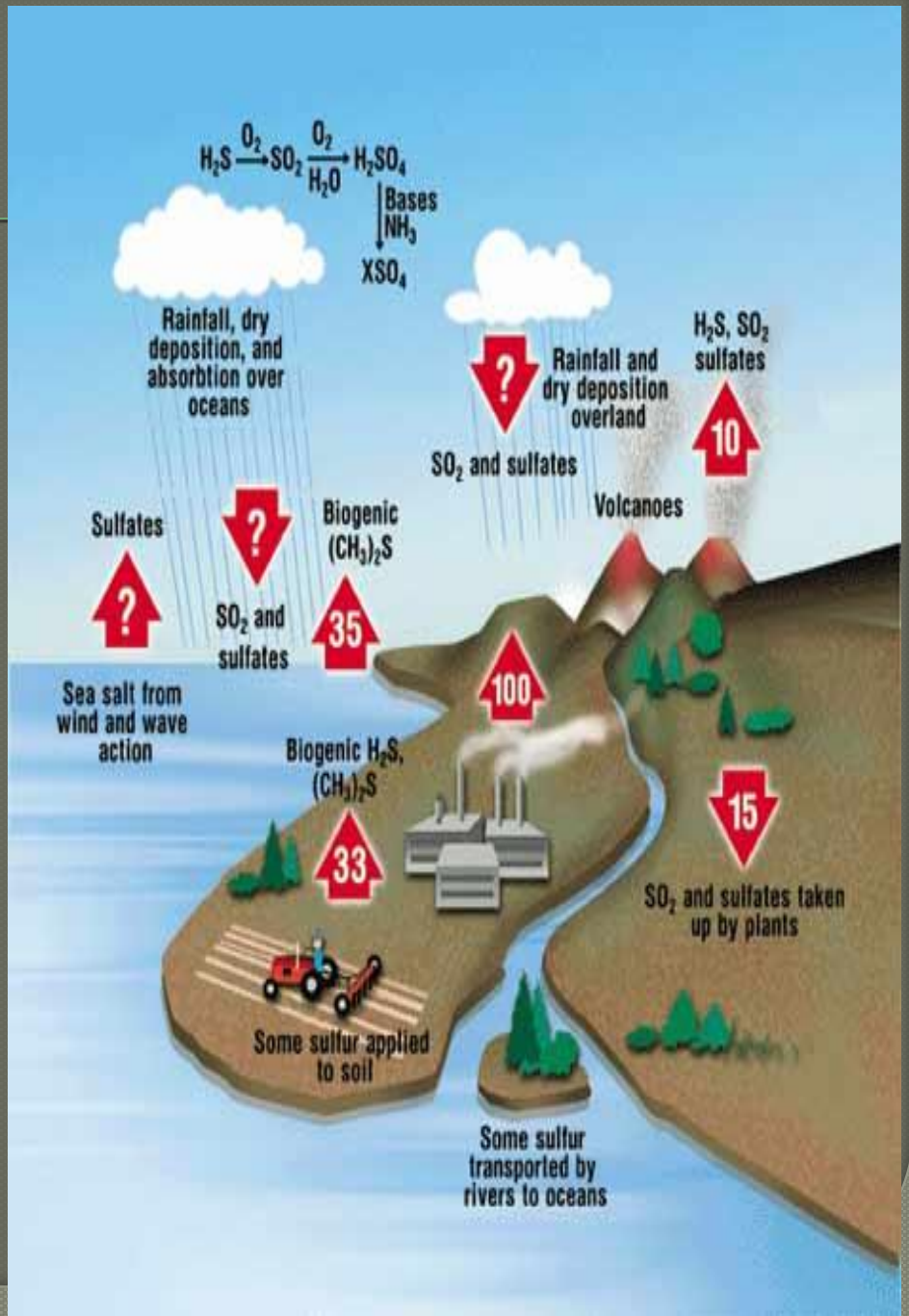
- **Sulfur** – mostly in rocks/oceans (magma)

Release:

- Volcanoes & vents ($SO_2$)
- Oceans (sulfates)
- Factories ($H_2S$) - coal
- Acid Rain (sulfuric acid)

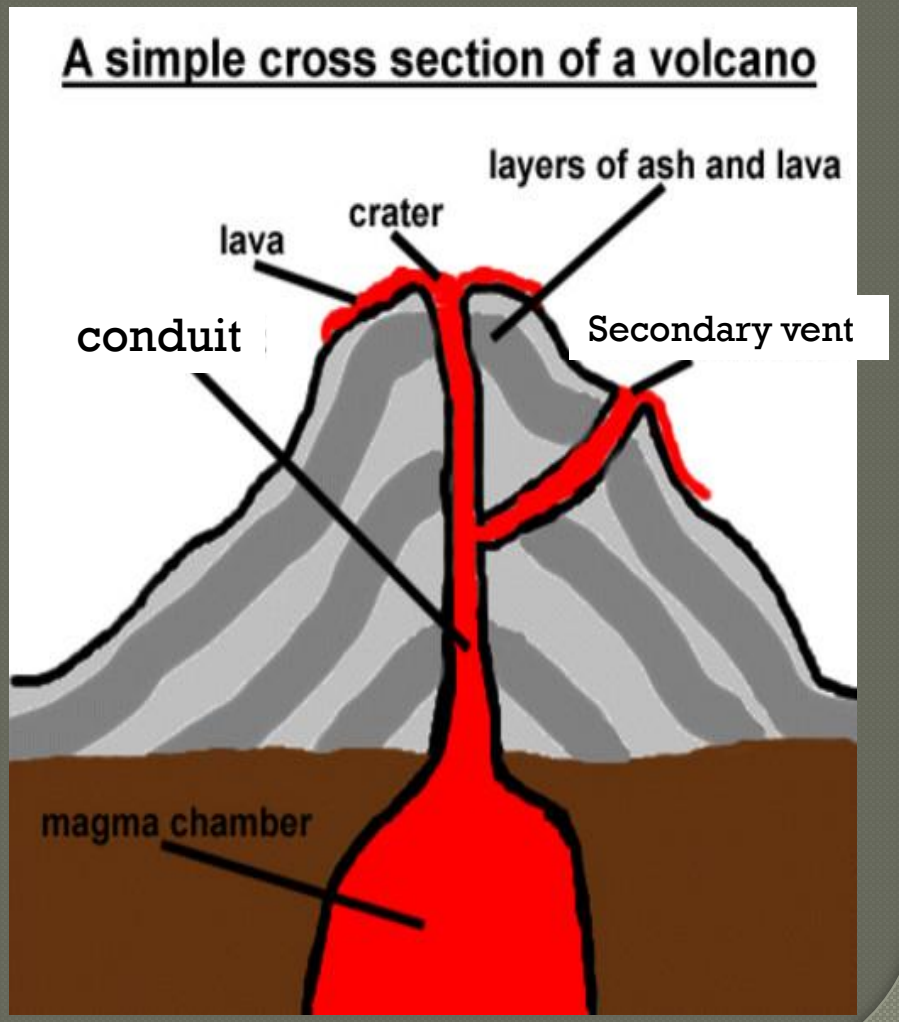
Absorbed:

- Plants & soil ($SO_2$)
- Oceans ($SO_2$, sulfates)



# Volcano Anatomy

- **Magma chamber** – where magma is stored
- **Conduit** – pipe where magma runs up
- **Vent** – where magma exits volcano (as lava)
- **Pyroclastic flow** – ash cloud post eruption



# Types of Volcanoes

- **Active** – regularly erupting volcanoes
  - Less dangerous
  - **Kilauea** (Hawaii) – gentle magma flow
- **Dormant** – usually inactive volcano
  - Dangerous (pressure)
  - Mount St. Helens
- **Extinct** – no longer an active volcano

# Mount St. Helens

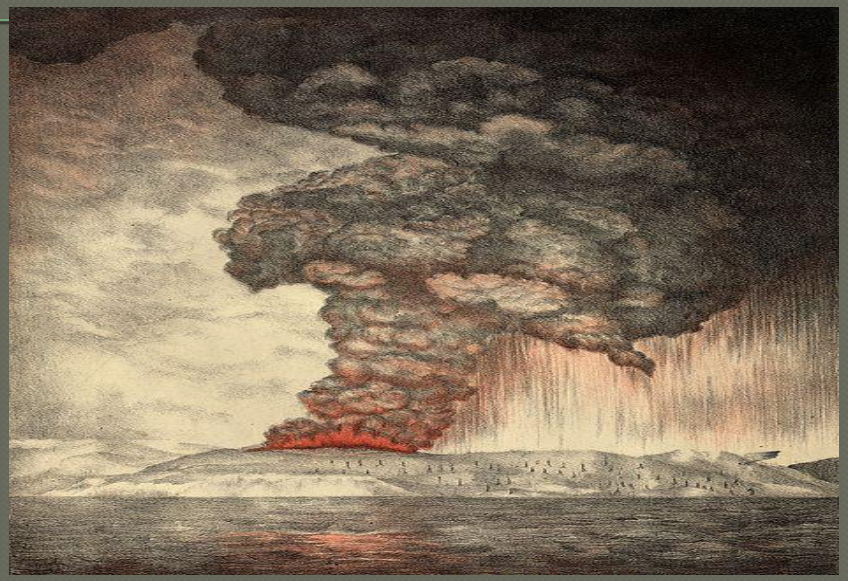
- Washington State
  - Series of Earthquakes
- Eruption = mountain landslide
- Ash and gas = increased soil erosion, destroyed ecosystems, killed 57

# Mount Pinatubo: The Honey-Badger Volcano

- June, 1991 – Philippines
- Eruption = 18 mill. tons of $SO_2$
  - Largest ever
- Ash spread all over Earth
  - Increased Sun reflection
  - Earth temp. lowered 2oF for 3 years!

# Krakatoa = Baller.

- Indonesia – most active volcanoes
- 1883 Eruption
  - Loudest sound ever recorded (3,000 miles)
- 36,000-120,000 deaths
- Wiped out entire island!



# Jobs Near Volcanoes

- **Volcanologist** – studies volcanic activity
- **Sulfur Mining** – cutting pieces of sulfur (yellow)

Ijen (Indonesia)

- 12 mile hike, carry 200 lbs
- $6 / day
- Protection = bandanas over mouth/nose

# Warm Up #5

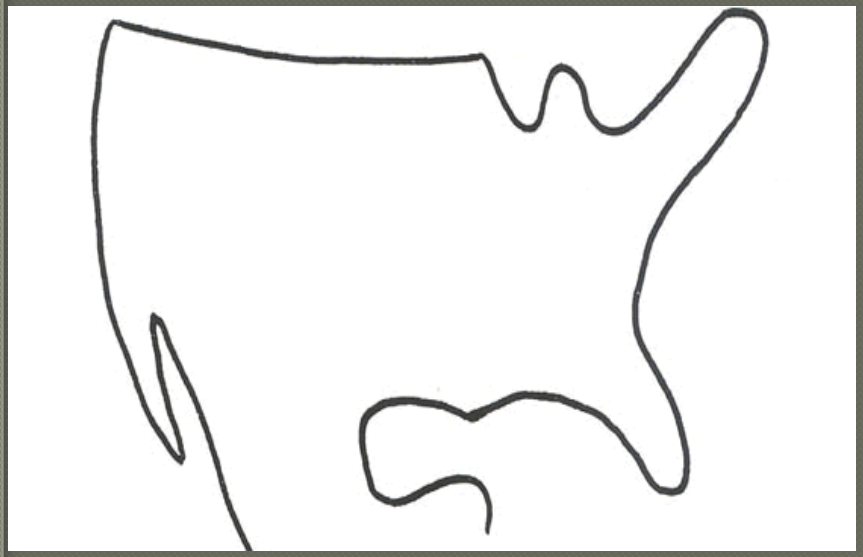
- Draw a volcano and label the following: crater, base, magma chamber, lava, pyroclastic ash, conduit, vent
- How can a volcanic eruption lower global temperatures? Give an example where this has occurred.
- Why can working near a volcano be dangerous (two reasons)?

# Warm Up #6

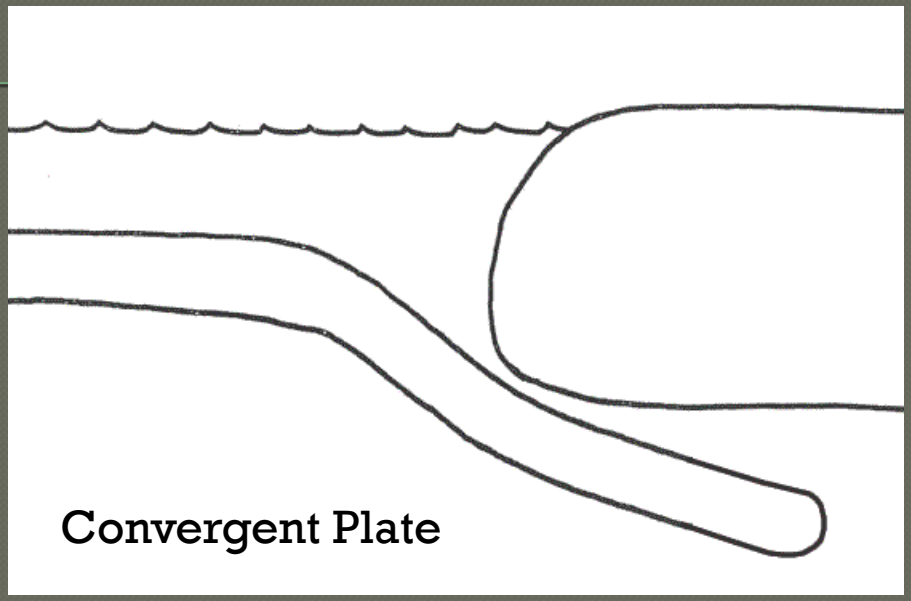
- Describe how divergent, convergent and transform plate boundaries work.
- How do scientists measure how strong an earthquake is? What is the highest level on this measurement?
- Which US state do you think has the most earthquakes? Why did you choose this state?

# Earthquakes

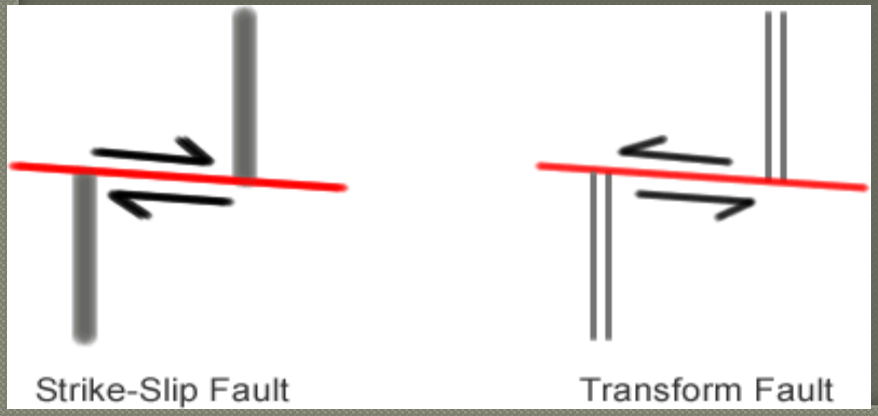
# Tectonic Plate Review

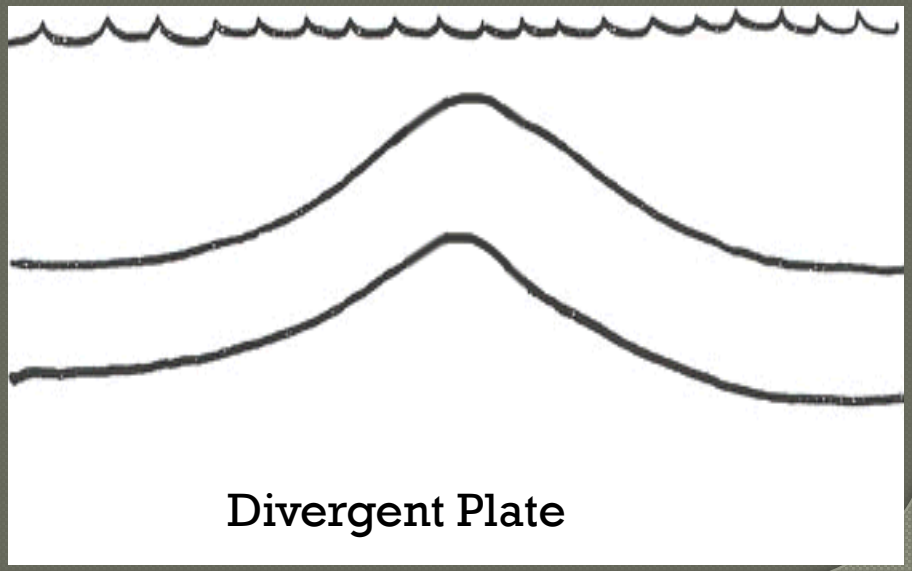


Transform Plate



Convergent Plate

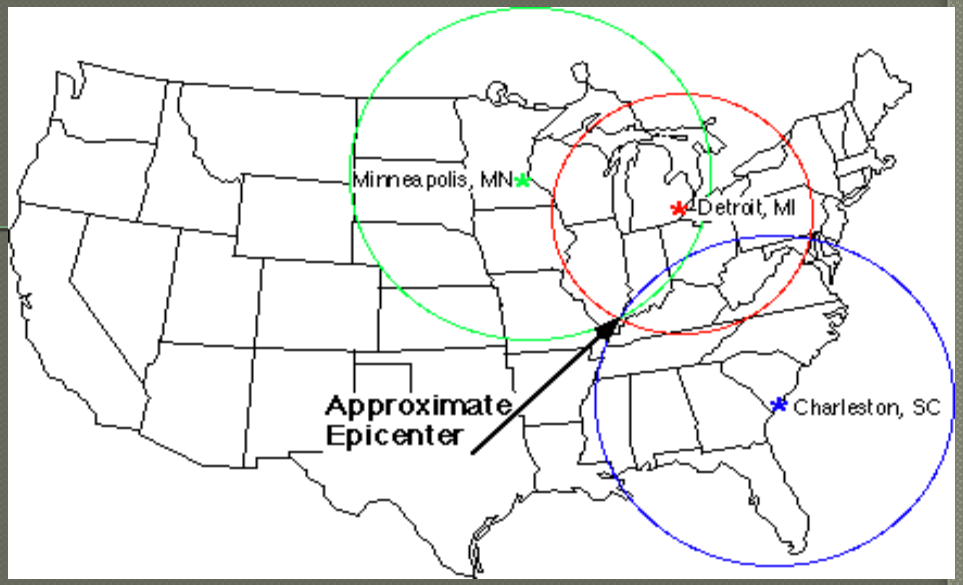


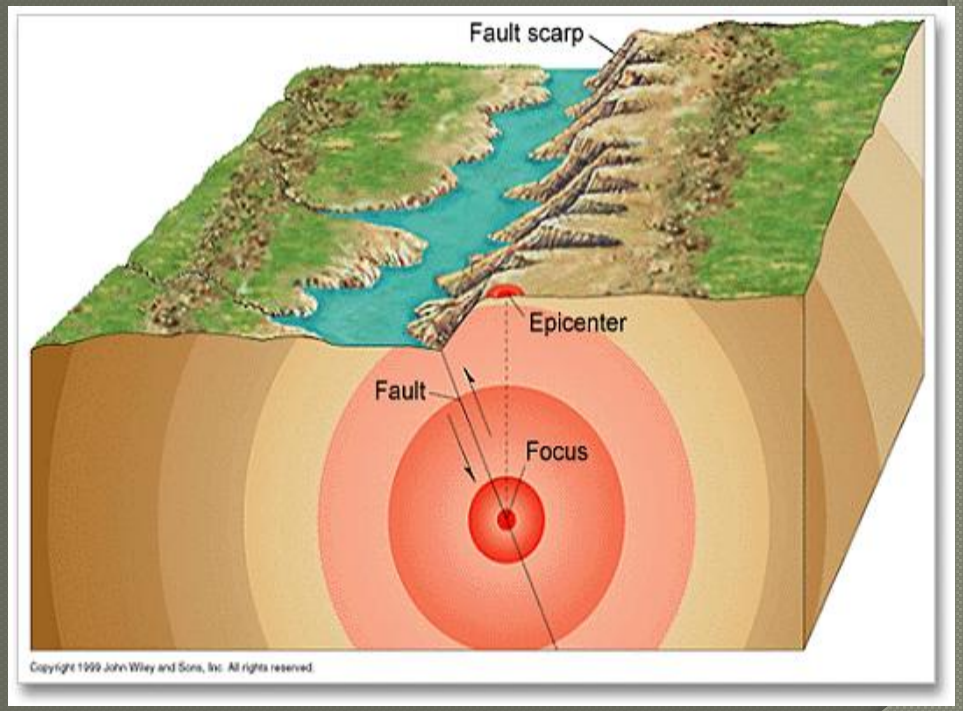



Divergent Plate

# Earthquakes

- **Earthquake** – abrupt movement of plates
  - release of energy (friction)
- **Focus** = location of quake beneath surface
- **Epicenter** = location ON Earth's surface
  - 3 locations needed
- **Seismology** – study of earthquakes



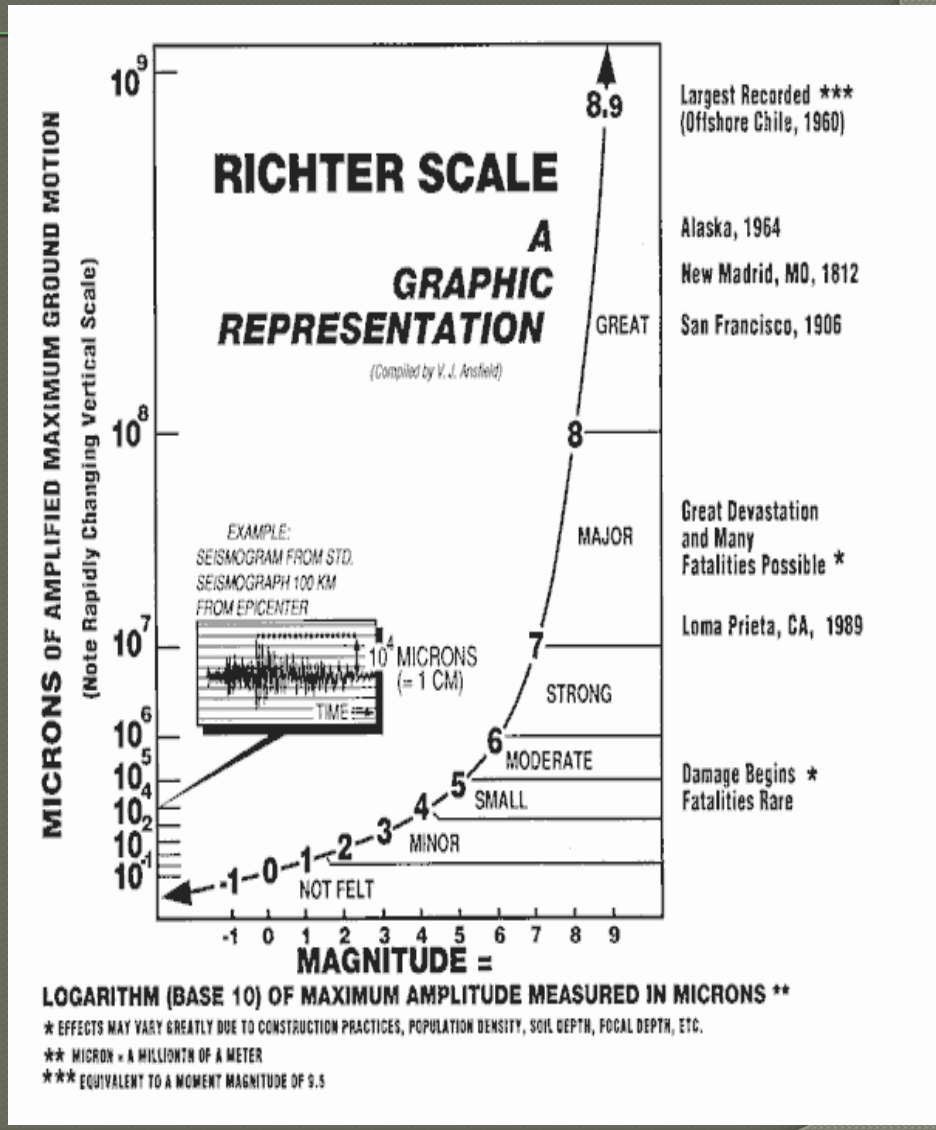



# Measuring Earthquakes

- **Richter Scale** – measurement of wave size (logarithmic – like pH)
  - 1-10

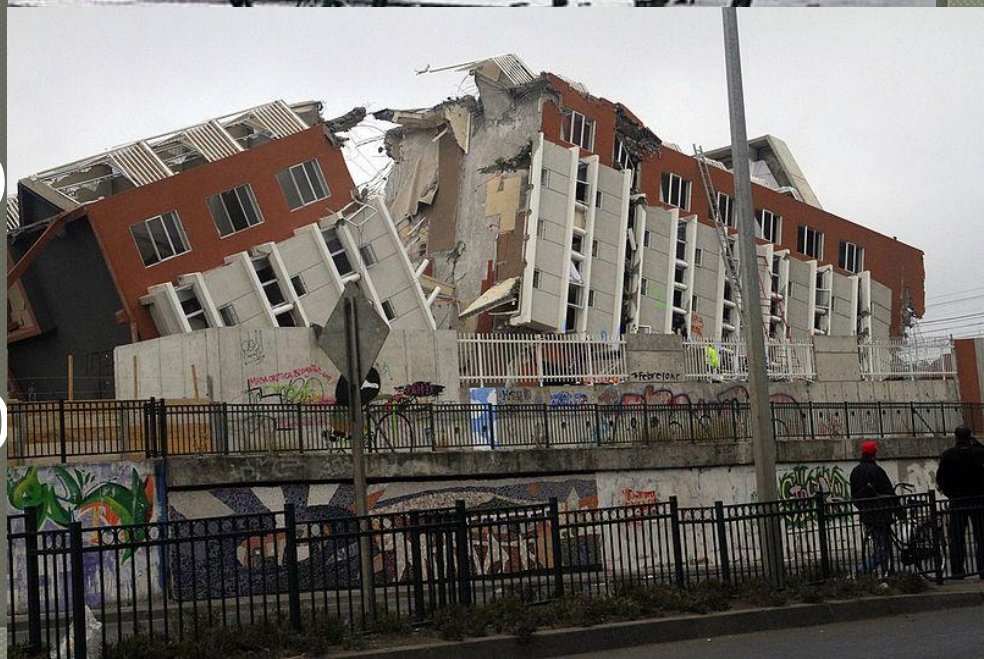
Compare 5.0 and…

- 5.1 = 1.3x greater
- 5.5 = 5.5x greater
- 6.0 = 10x greater
- 7.0 = 100x greater
- 8.0 = 1000x greater



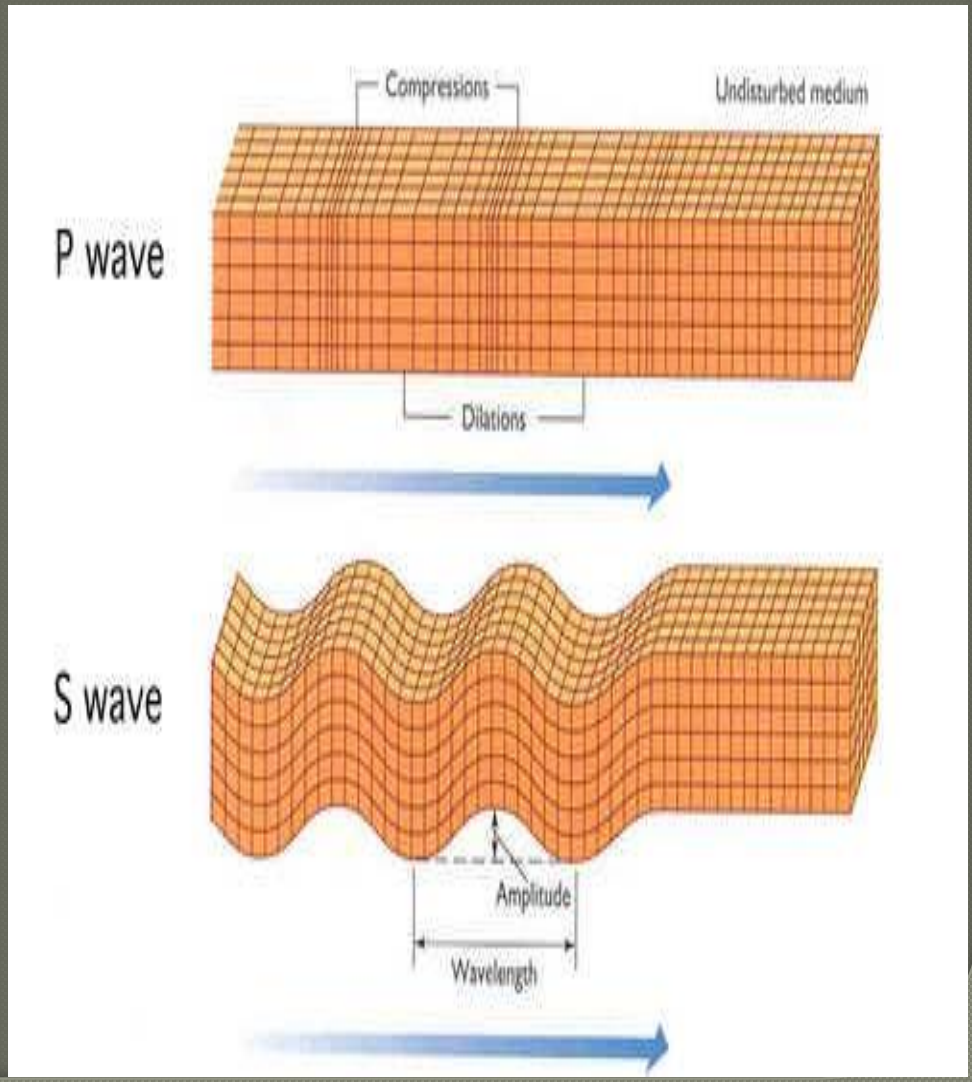
# Richter Scale Examples

- Haiti Earthquake (2010)
  - 7.5
- San Francisco Earthquake (1906)
  - 8.0
- Chile Earthquake (2010)
  - 8.8
- Japan Earthquake (2011)
  - 9.0



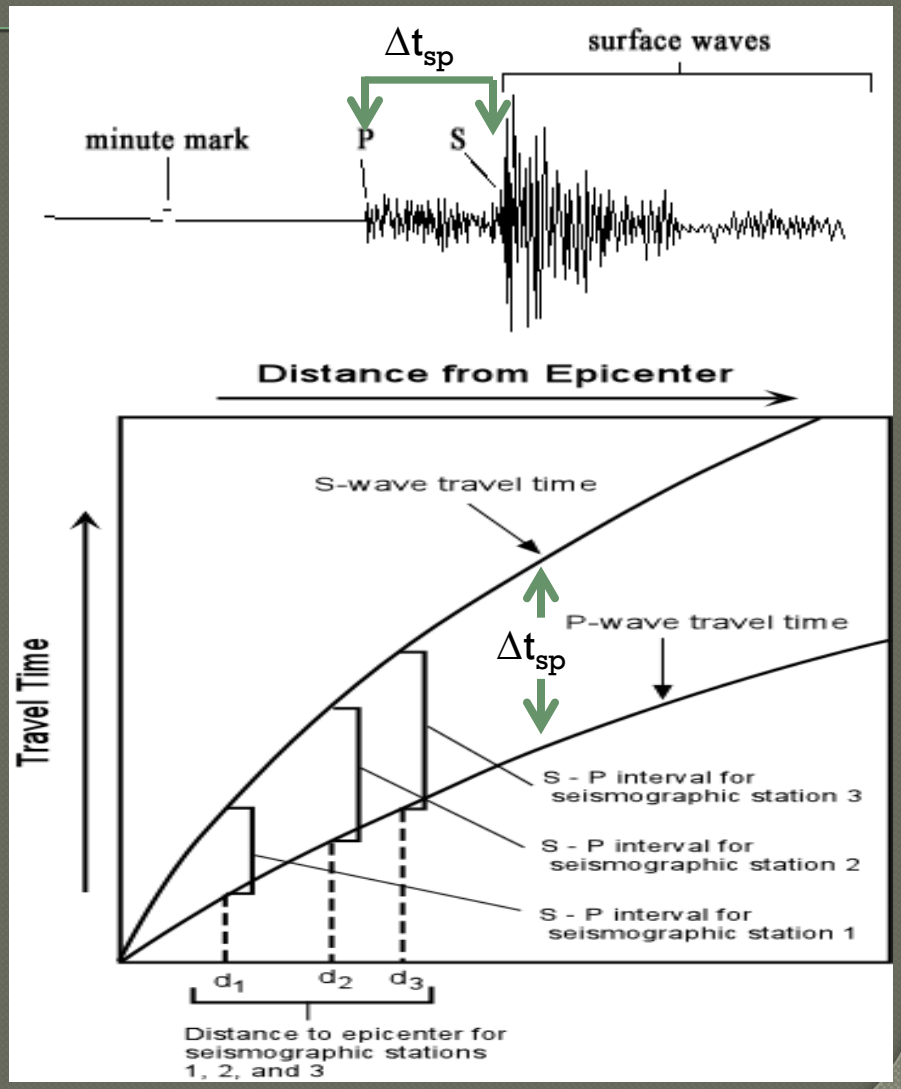
# P and S Waves

- **P-Wave** – primary wave, always felt first
- **S-Wave** – secondary wave, always felt second
  - Wavy-looking
- Difference in time between P and S wave = $\Delta T_{sp}$



# $\Delta T_{sp}$ and Epicenter

- **Seismogram** – reading of P and S wave in a location
  - [$\Delta T_{sp}$ = s-wave starts – p-wave starts]
- On graph (given)
- Epicenter needs 3 locations



# Quick Quiz #3

- How does an earthquake epicenter differ from its focus?
- What is a seismogram? What does it measure?
- If one earthquake was 8.0 on the richter scale, how much stronger is a 10.0 earthquake?

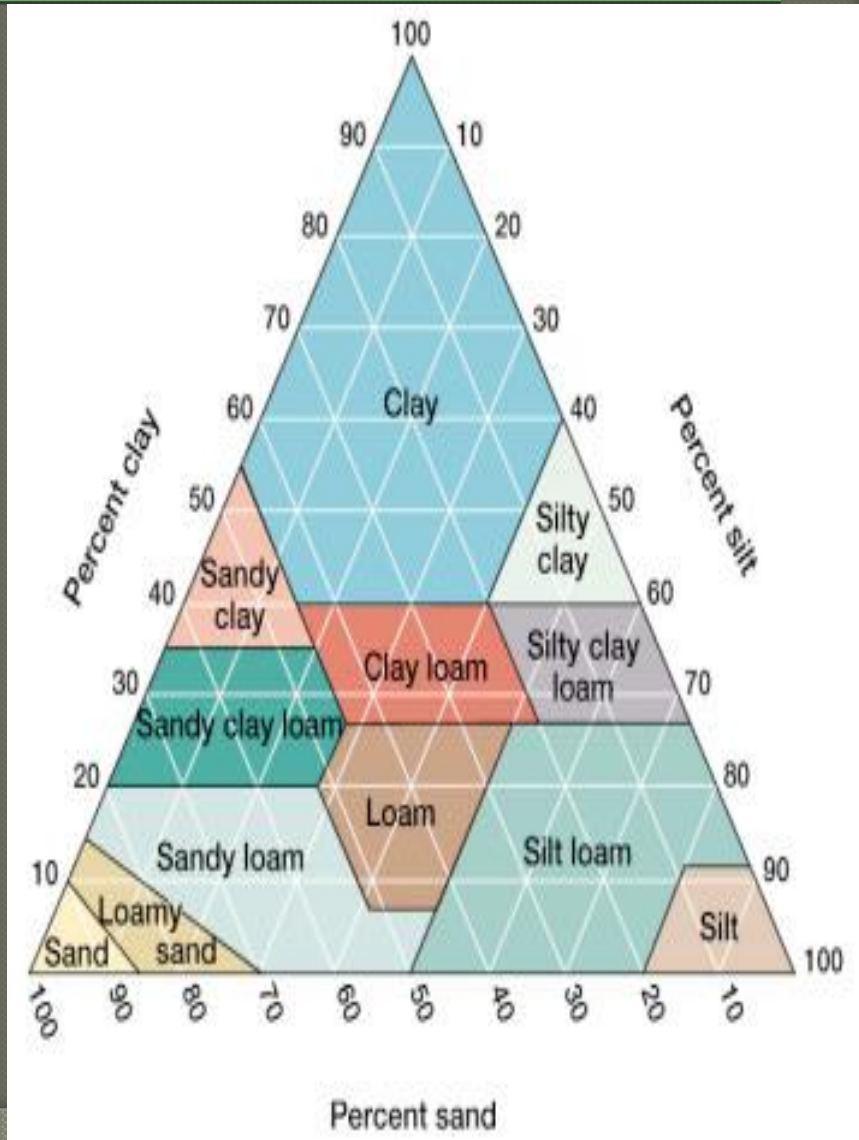
# Warm Up #7

- What is the $\Delta T_{sp}$ measuring? Why do P-waves felt sooner than S-waves?
- What is an epicenter? How many locations are needed to determine it?
- What are the three major requirements for plants to grow?

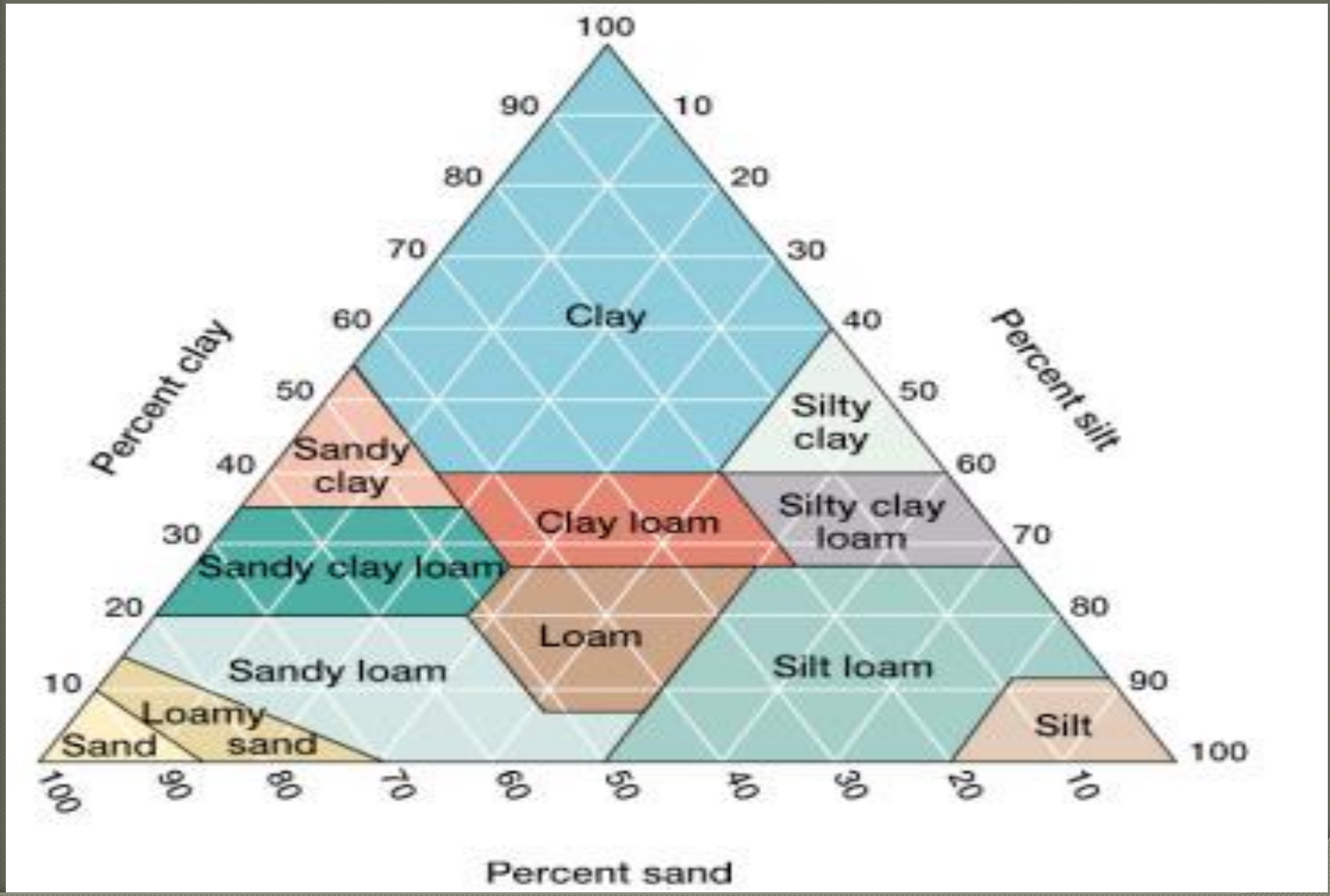
# Soil

# Components of Soil

- **Clay** – clumpy, sticky, tiniest particles
  - Easily waterlogged
- **Sand** – large particles, gritty sediment
  - Plants needing little water
- **Silt** – medium-sized particles, smooth
  - Easily moved by water
- **Loam** – nutrient-rich, spongy, medium particles
  - The happy medium
  - Plants grow best

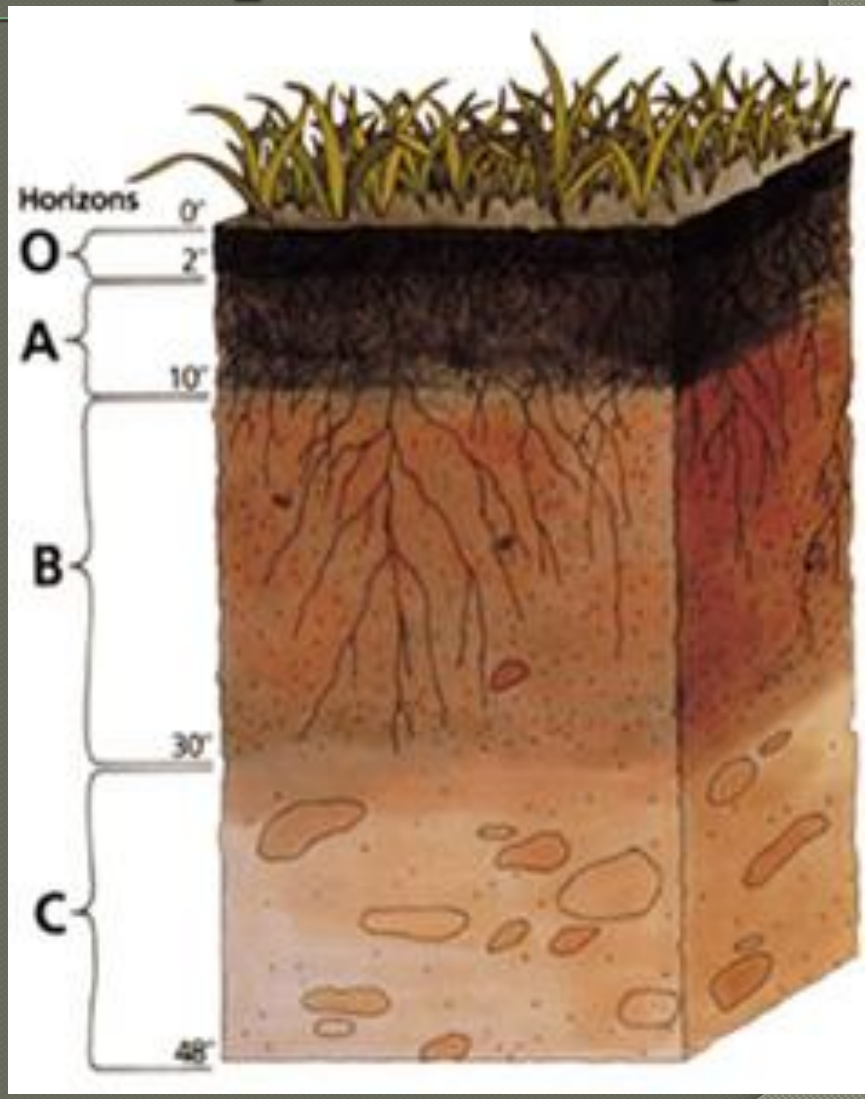


# Soil Texture Triangle



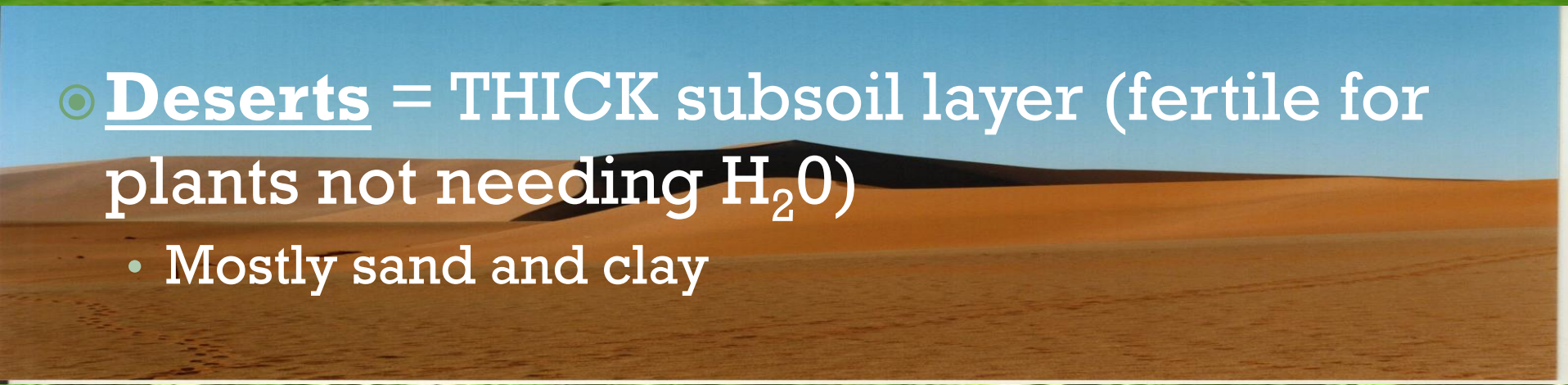
# Layers of Soil [Horizons]

- **O Horizon** = surface
  - Mostly decomposed matter
  - THICK in deciduous forests
- **A Horizon** = **topsoil** (where stuff can grow)
  - THICK in grasslands
- **B Horizon** = subsoil
  - Nutrient-rich, where roots end
- **C Horizon** = parent material
  - Bedrock, no plant growth



# Soil & Biomes Revisited

- **Grasslands** = THICK topsoil layer (fertile, nutrient-rich)
  - Mostly loam and clay



- **Deserts** = THICK subsoil layer (fertile for plants not needing $H_20$)
  - Mostly sand and clay

- **Most Forests** [tropical, temperate, boreal] = acidic topsoil (nutrient-poor)
  - Mostly clay, silt and loam

# How Soil is Made

- Climate
  - Precipitation and temperature of a region
- Living Organisms
  - Decomposers (putting nutrients in soil)
- Topography (landscape)
  - Hilly landscape = more erosion
  - Elevation, wind exposure = other factors

# Soil Erosion

- **Erosion** – movement of rock/soil from one place to another
  - Wind, water, human activity
- Result: desertification, less fertile soil, more acidic soil (rainforests)
- Positive feedback loop
- **Sheet erosion** – soil moves off as horizontal layer (strips of soil)

# Case Study: Dust Bowl & Compost

- **Dust Bowl** – Oklahoma, Texas Kansas (windy)
  - Prairie plowing = soil erosion (topsoil gone)
- **Compost** – recycled organic matter.
  - Nutrient rich
  - Restores soil
  - Ex. egg shells, coffee grounds, veggies, paper

# Quick Quiz #4

- Draw the soil texture triangle, and decide where Sand, Silt, Clay and Loam are on the triangle
- What are the 4 major "horizon" levels of soil? What is found at each level?
- What is erosion, and what are the major effects of it on an area, giving one example.

# Warm Up #7

- Draw the soil texture triangle. Which type of soil is ideal for plant growth, and why?
- How would you describe the soil in a grassland? How does it compare to a desert?
- What sorts of things influence the type of soil in an area?

# Chapters 5 and 14 Review Slides

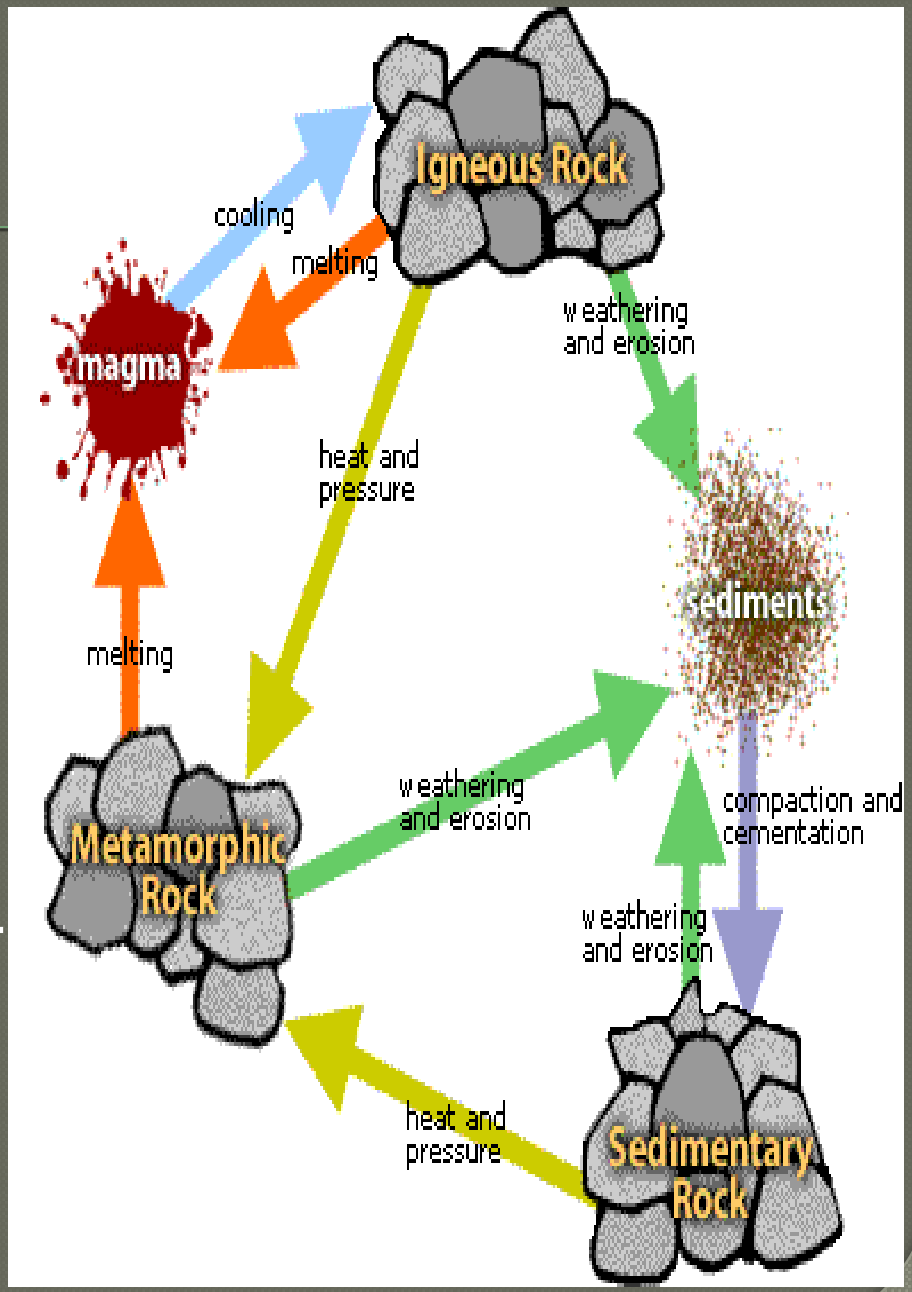
# Rocks

Layers

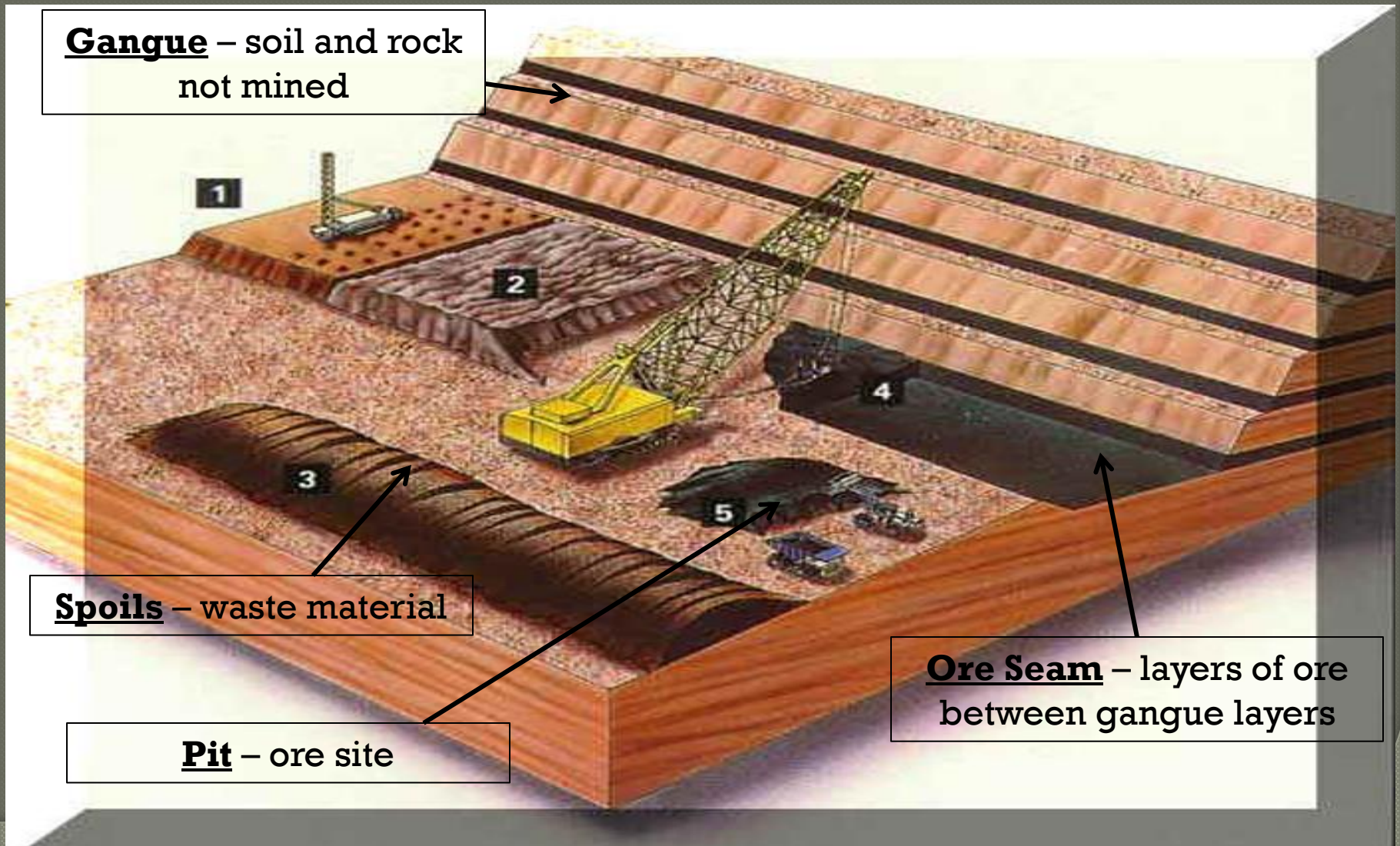
- Inner Core (solid, hottest)
- Outer Core (liquid)
- Mantle (thickest)
- Crust (thinnest)

Types

- **Igneous** – magma cools
  - Most common
- **Metamorphic** – heat and pressure
  - Coal
- **Sedimentary** – compacting
  - Fossils, common on surface



# Strip Mining Pictured



# Mining

Minerals – valuable material being mined for

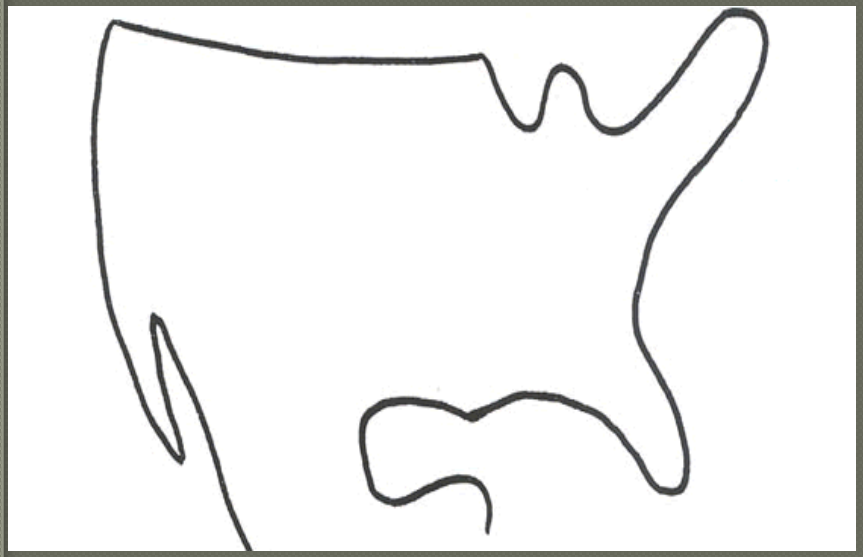
Types

- Open Pit - drill
- Surface - digging
- Strip – strips of ore off

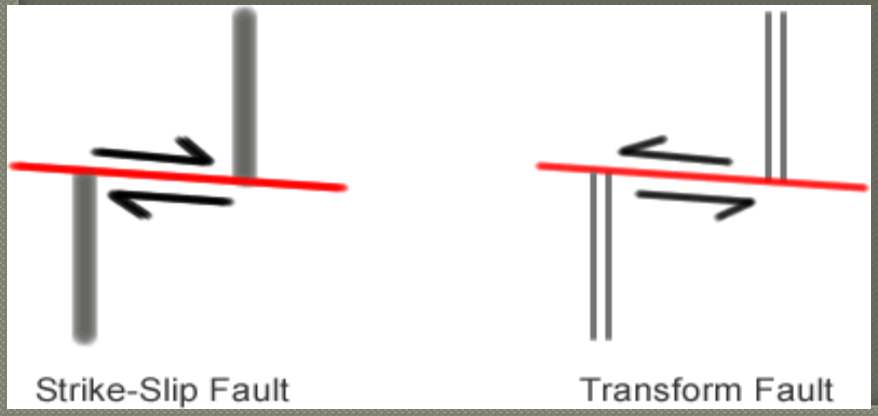
- Canaries & enviro problems
  - Lungs, acid rain, cave-ins

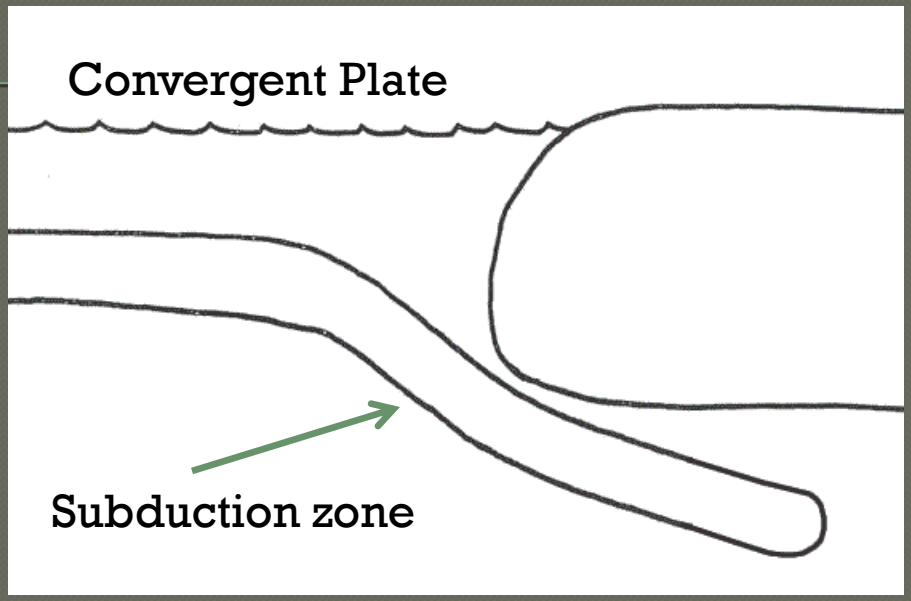
- Supply and Demand

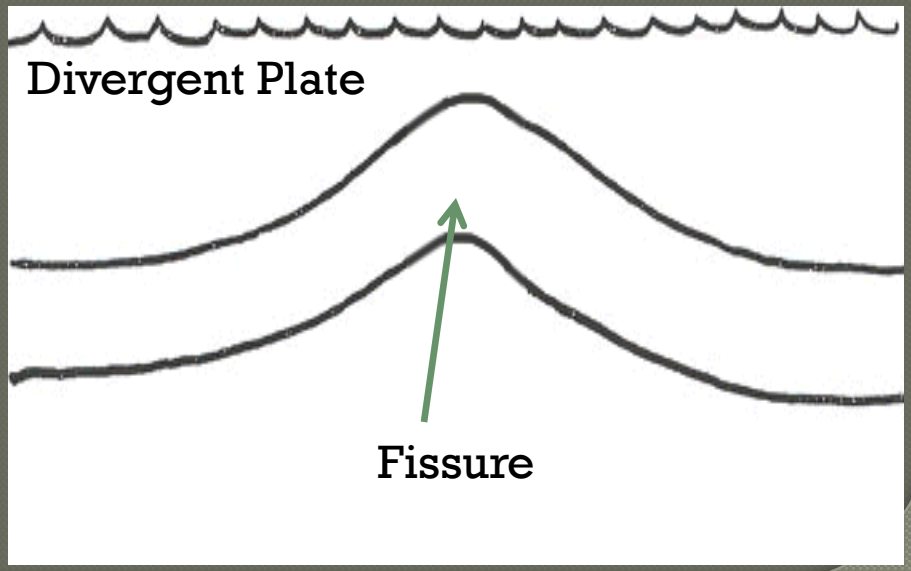
# Tectonic Plate Review



Transform Plate



# Volcanoes and Earthquakes

- **Volcanoes** – convergent, divergent or hot spots
  - Ash, magma, $SO_2$ gas
  - Dormant vs. active
  - Pinatubo vs. Kilauea

- **Earthquakes** – convergent, divergent, transform
  - Richter scale (each # = 10x)
  - P & S waves ($\Delta$Tsp)
  - Seismogram
  - Epicenter vs. focus

# Sulfur Cycle

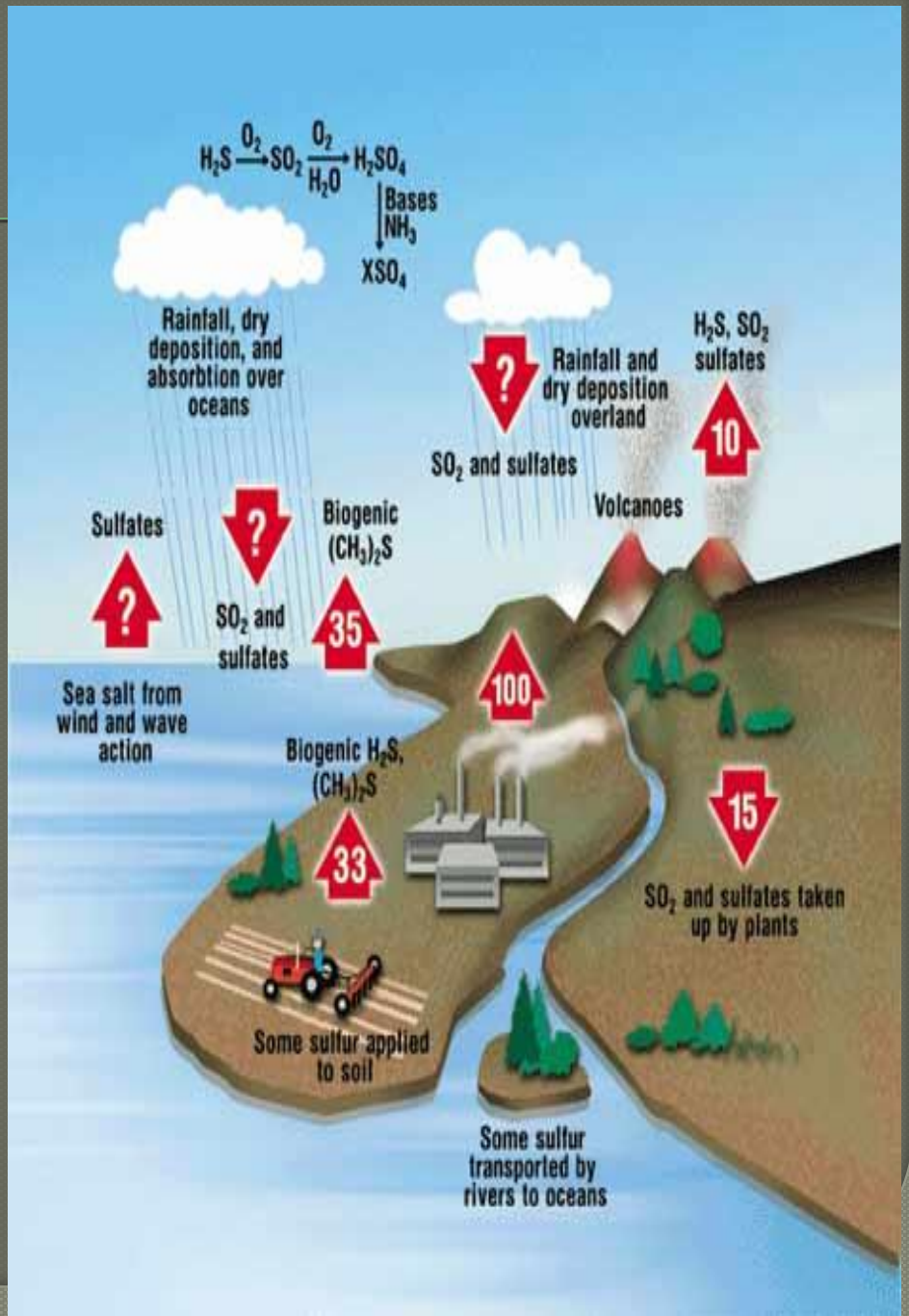
- **Sulfur** – mostly in rocks/oceans (magma)

Release:

- Volcanoes & vents ($SO_2$)
- Oceans (sulfates)
- Factories ($H_2S$) - coal
- Acid Rain (sulfuric acid)

Absorbed:

- Plants & soil ($SO_2$)
- Oceans ($SO_2$, sulfates)



# Soil & Biomes Revisited

- **Grasslands** = THICK topsoil layer (fertile, nutrient-rich) – mostly loam & clay
  - Rainy and dry seasons (chaparral, grasslands, savanna)
- **Deserts** = THICK subsoil layer (fertile for plants needing little $H_20$) – sand & clay
  - Little to no rain (hot & dry, semi-arid, cold)
- **Most Forests** = acidic topsoil (nutrient-poor) – silt, loam, clay
  - Rain all year (tropical, temperate, boreal)

# Soil

TYPES

- **Sand** – large particles, plants w/ little H20
- **Clay** – tiniest particles, water-logged
- **Silt** – medium-sized, water moves it
- **Loam** – the happy medium

LAYERS

- O-Hori. = surface
- A-Hori. = topsoil
- B-Hori. = subsoil
- C-Hori. = parent material