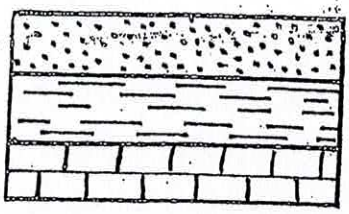
The Dynamic Crust

I. EVIDENCE OF CRUSTAL CHANGES

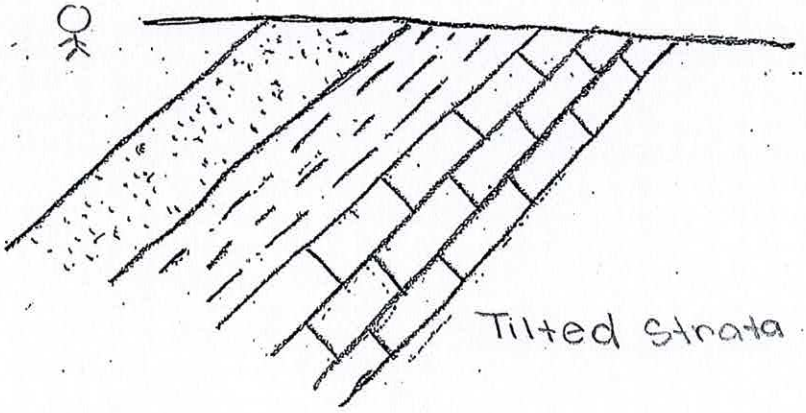
A. Deformed Rock Structure – sedimentary strata could (layers of sedimentary Rock) form in a horizontal position. Any change from the horizontal position is evidence of minor crustal change.



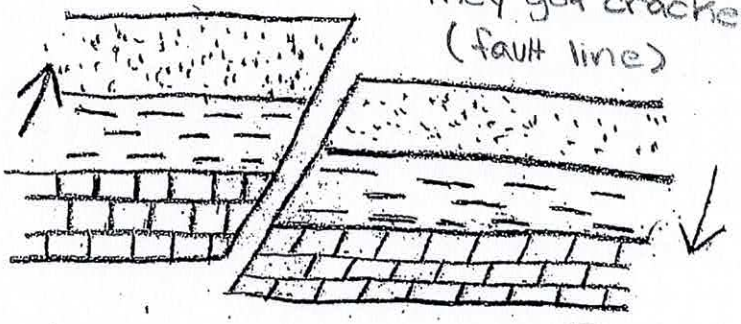
Normal undisturbed layers
(no motion)

1.

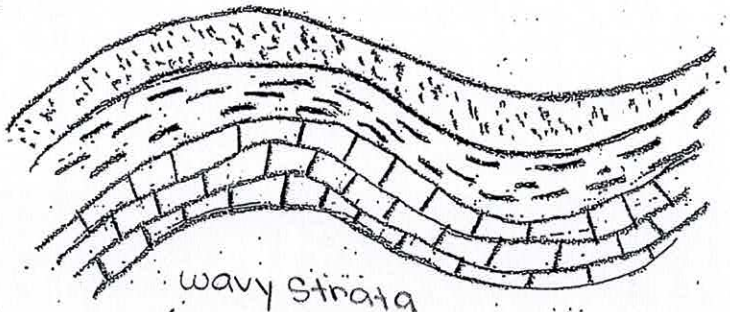
OR



2.

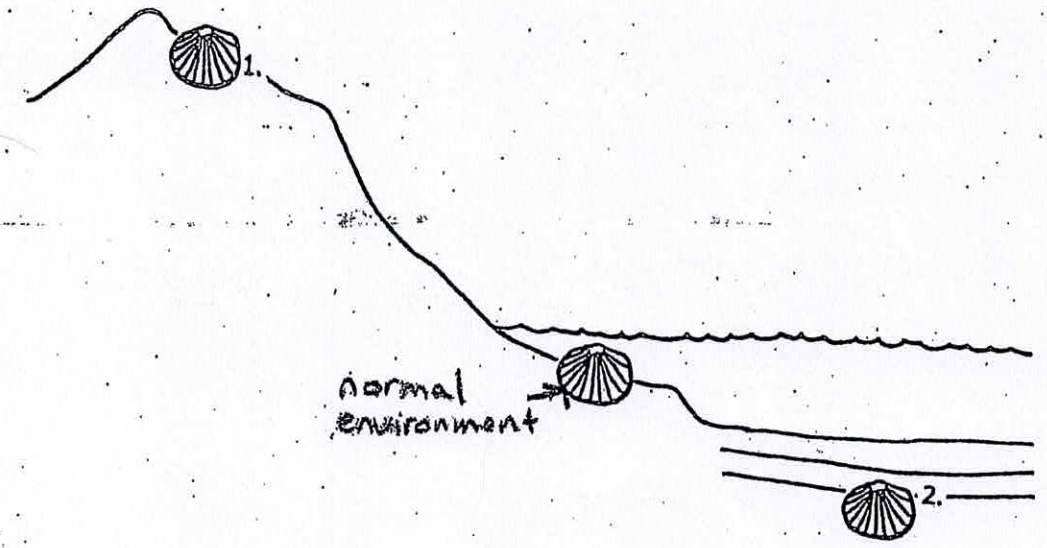


3.



hi

B. Fossil Evidence



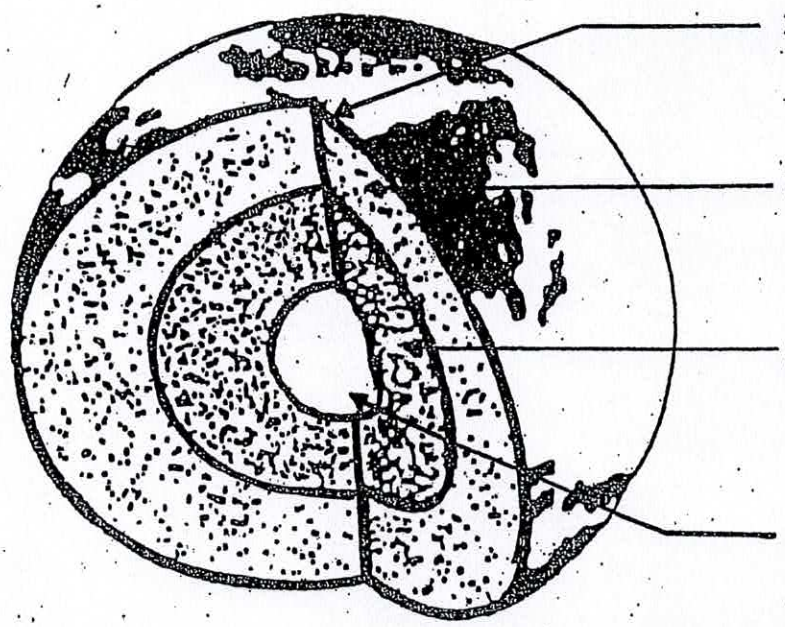
1. Marine fossils found at high elevations suggest uplighting.
2. Shallow water marine fossils found at great ocean depths suggest subsidence / sinking.

II. PLATE TECTONICS

A. Earth's Structure

Rerefence table page 11.

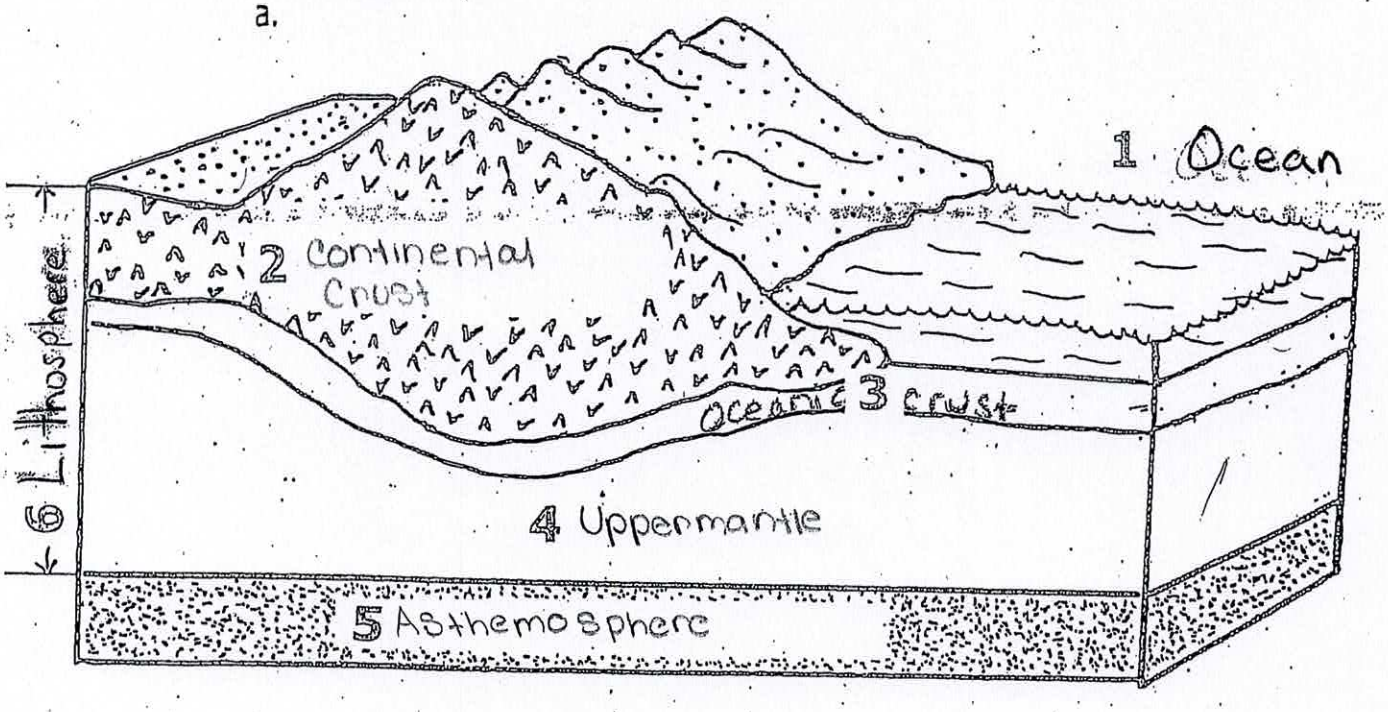
1. Earth's Interior



1. Crust
   5 - 50 km thick
   Density 2.7 - 3.0 g/cm³
2. Mantle
   2,850 ~~2900~~ km thick
   Density 3.4 - 5.6 g/cm³
3. Fluid outer core
   2,250 km thick
   Density 9.9 - 12.2 g/cm³
4. Solid inner core
   1,228 km thick
   Density 12.8 - 13.1 g/cm³

2. Earth's Surface

a.



b. Density of: 1. ocean (water) 1.0 g/cm³

2. granite (continental crust) 2.7 - 2.9

3. basalt (ocean crust) 3.0

4. rigid upper mantle
5. asthenosphere
} 3.3 - 5.5 g/ml

c. Lithosphere = crust + upper mantle

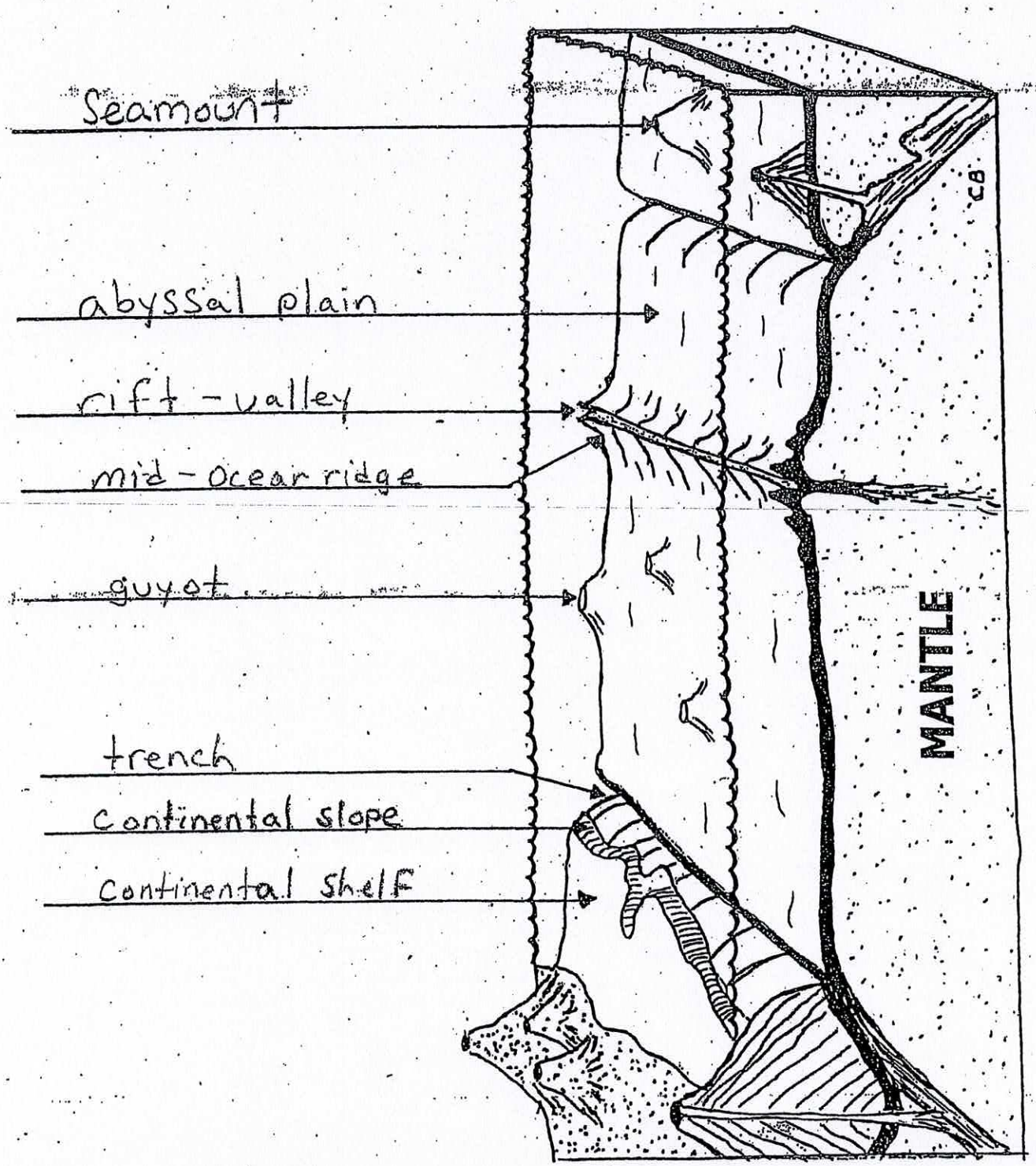
d. asthemosphere the plasticlike layer below the lithosphere in Earth's mantle. 30 - 50 km

e. Thickness of: 2. Continental Crust ~~32 km average~~ (100 km)

3. Ocean Crust ~~5 - 8 km~~ 5 - 15 km

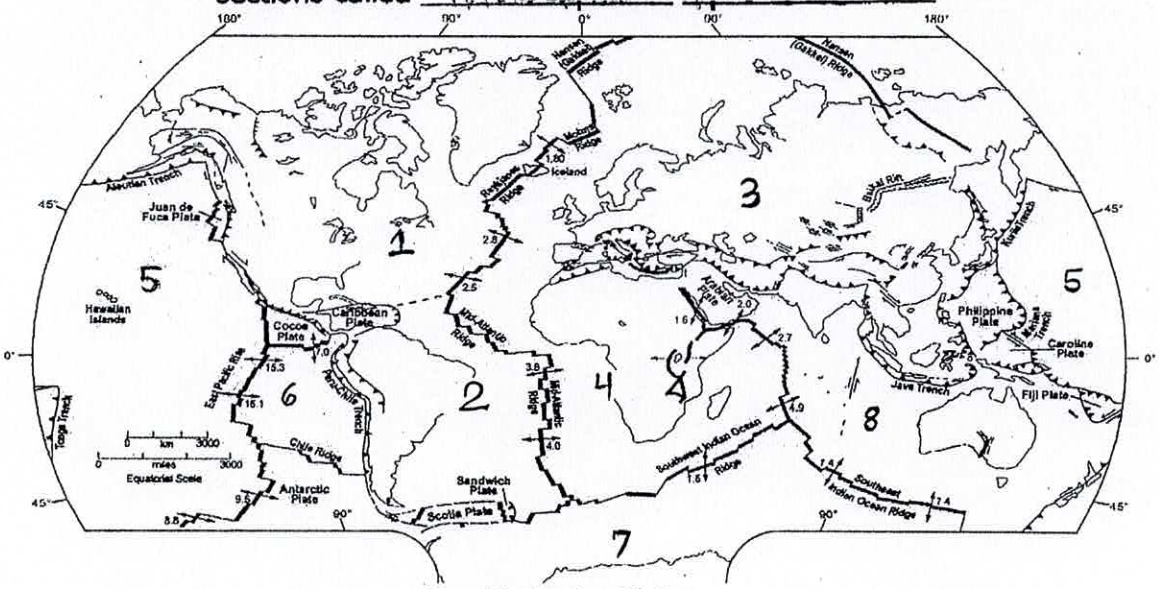
C. Theory of Sea Floor Spreading

1. Topography of the Ocean Floor



C. The Theory of Sea Floor Spreading

1. The theory of Plate Tectonics states that Earth's lithosphere (crust + upper mantle) is divided into sections called lithospheric plates.



Key To Major Plates

1. North American Plate
2. South American Plate
3. Eurasian Plate
4. African Plate
5. Pacific Plate
6. Nazca Plate
7. Antartic Plate
8. Indian-Australian Plate

2. Plate Motion – The theory of Plate Tectonics states that these lithospheric plates are in motion and "float" or ride on the Asthenosphere.
3. Direction of Plate Movement – The movement and interaction of tectonics plates creates 3 types of plate boundaries: the arrows on the tectonic map (page 8) show the relative motion.

PLATE BOUNDARIES	MOVEMENT	ARROWS ON MAP
divergent	away from each other	← →
convergent	towards each other	→ ←
transform	laterally or sideways	⇅

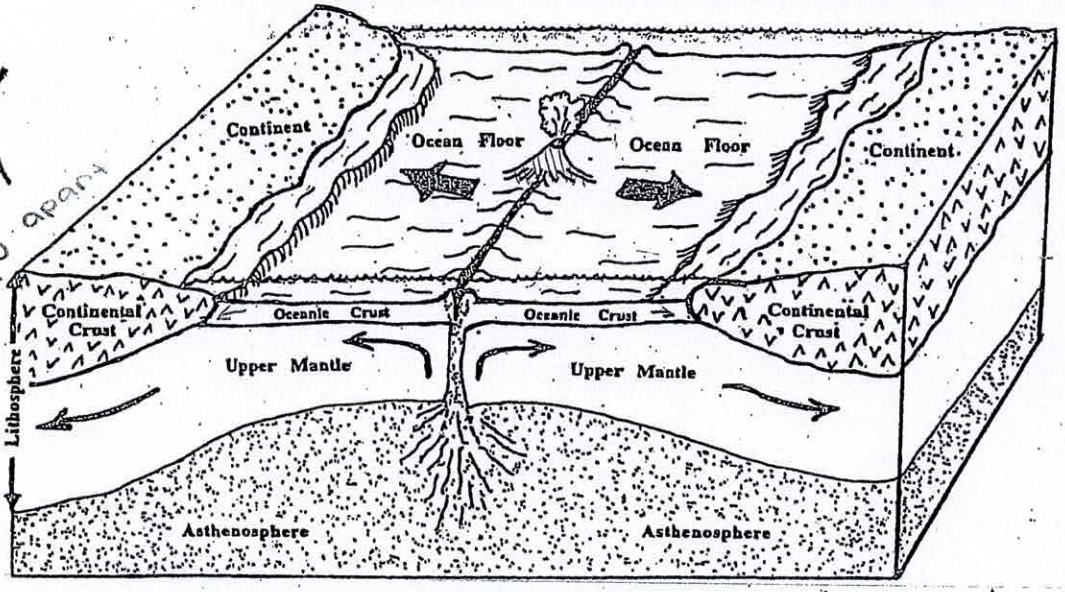
4. Types of Plate Boundaries

A. Divergent Plate Boundaries - where two plates are moving apart

1. Ocean (example) - mid atlantic ridge

1st type of Boundary

slowly moving apart magma under the crust (pushes up)



2. Continental (example) - Great Rift Valley/Africa

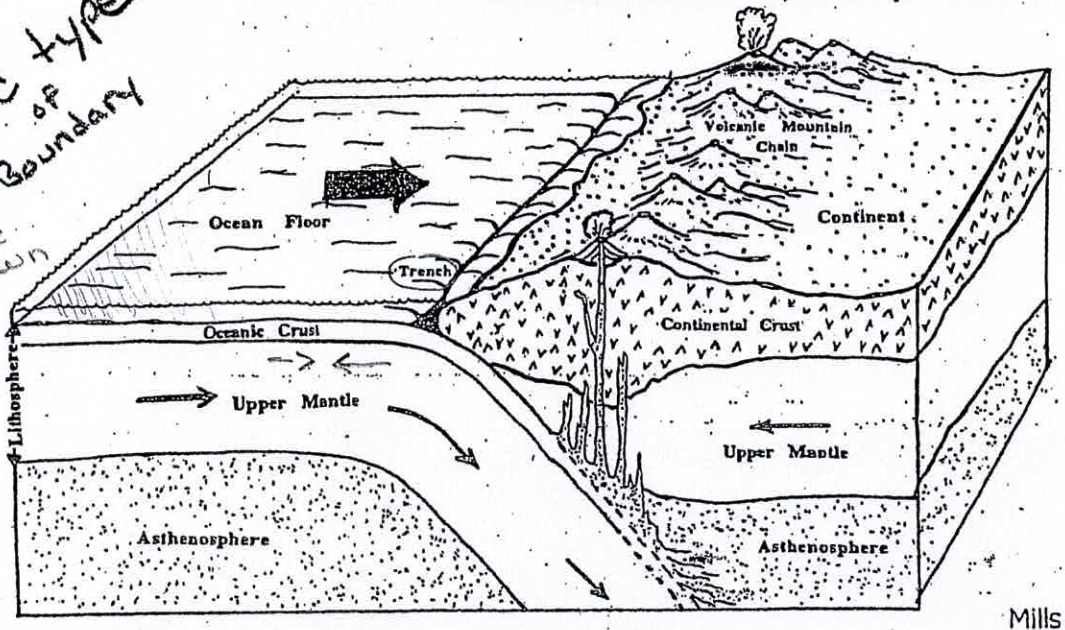
B. Convergent Plate Boundaries - where two plates come together / collide

cheesecake!

1. Oceanic-Continental (example) - Pacific (ocean plate) subducts under South American (continental plate)

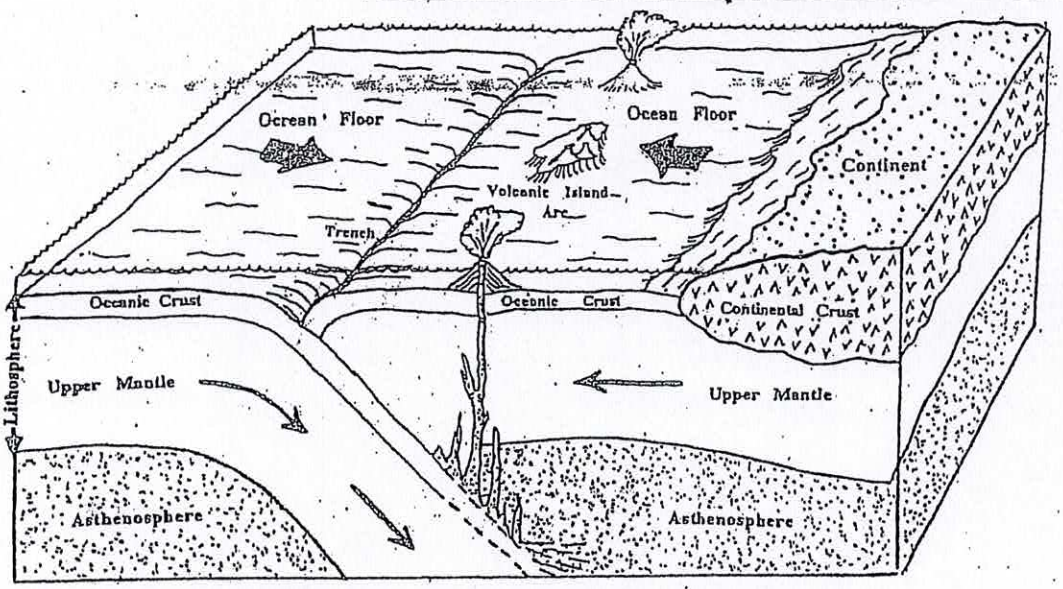
2nd type of Boundary

one will be forced down (oceanic) bc its thinner, slower, denser

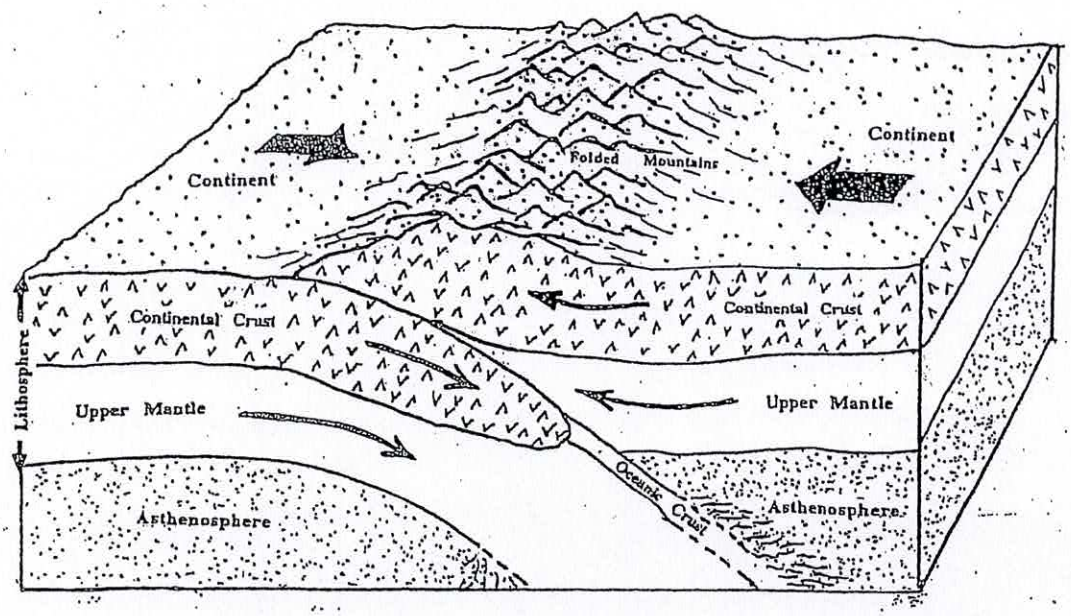


Subduction : where two plates collide and one goes under another

2. Oceanic-Oceanic (example) - Trenches and Island arcs of Japan and Aliuetian Islands (of Alaska)

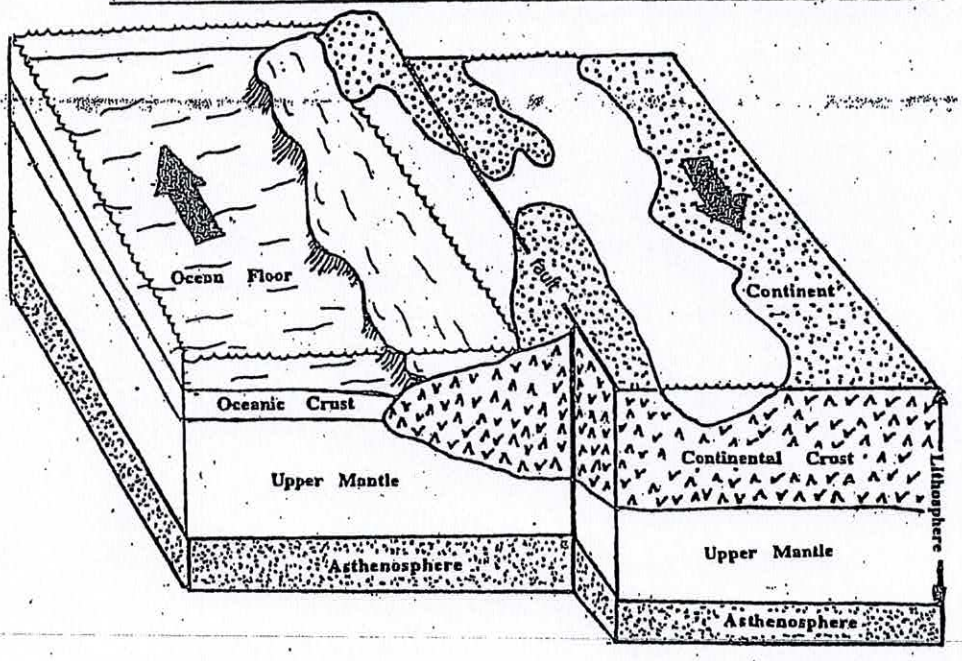


3. Continental-Continental (example) - India Colliding with Asia increasing the Himalaya Mountains height.



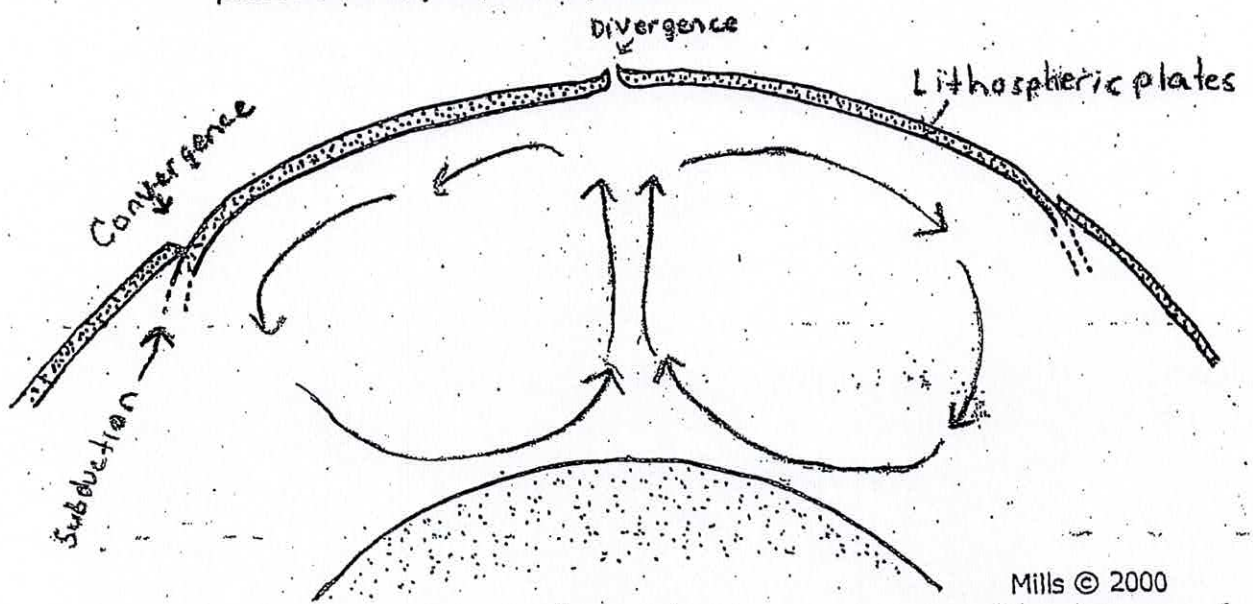
c. Transform Plate Boundaries (example) - where two plates are side by side ex. San Andrew fault

3rd type of Boundary



5. convection corrents = the driving force beneath plate tectonics

Hot less dense material form deep within Earth's mantle rises. When this material cools near the surface, it becomes more dense and sinks. The resulting convective flow of this material in the mantle carries/moves lithospheric plates across the surface of Earth.

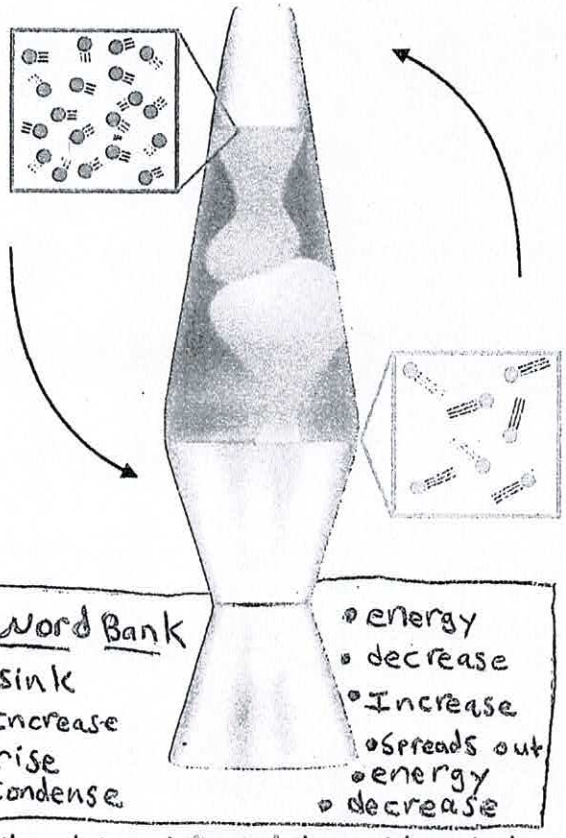


Gabrielle Roberts

THERMAL CONVECTION

Convection is the process where heat is transferred by the large movement of particles from a warmer location to a colder location.

What happens inside a lava lamp?

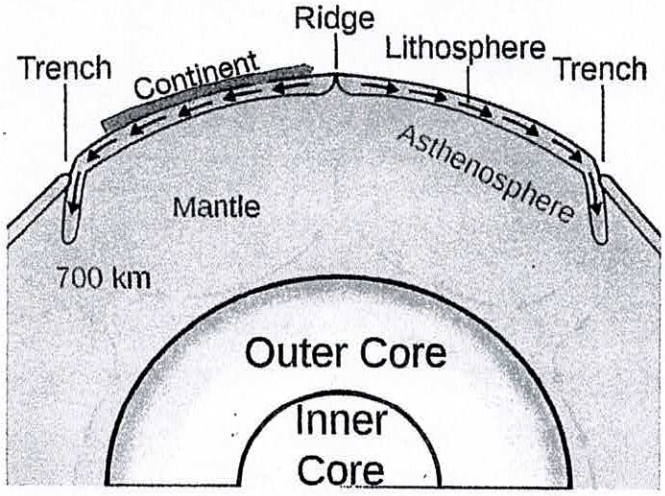


Word Bank
- sink
- increase
- rise
- condense
- energy
- decrease
- Increase
- spreads out
- energy
- decrease

When the substance is heated, the particles gain thermal energy. This makes them move faster and further and the substance rises. This makes the substances volume increase which causes the density to decrease and the substance to spreads out

When a substance is cooled, the particles lose energy. This makes them move slower and closer together and the substance sink. This makes the object's volume decrease which causes the density to increase and the substance to condense.

What happens inside the Earth's mantle?



Word Bank
- denser
- moves
- less
- Convection cells
- Convection

convection cells = the driving force beneath plate tectonics.

Hot, less dense material from deep within Earth's mantle rises. When this material cools near the surface, it becomes denser and sinks.

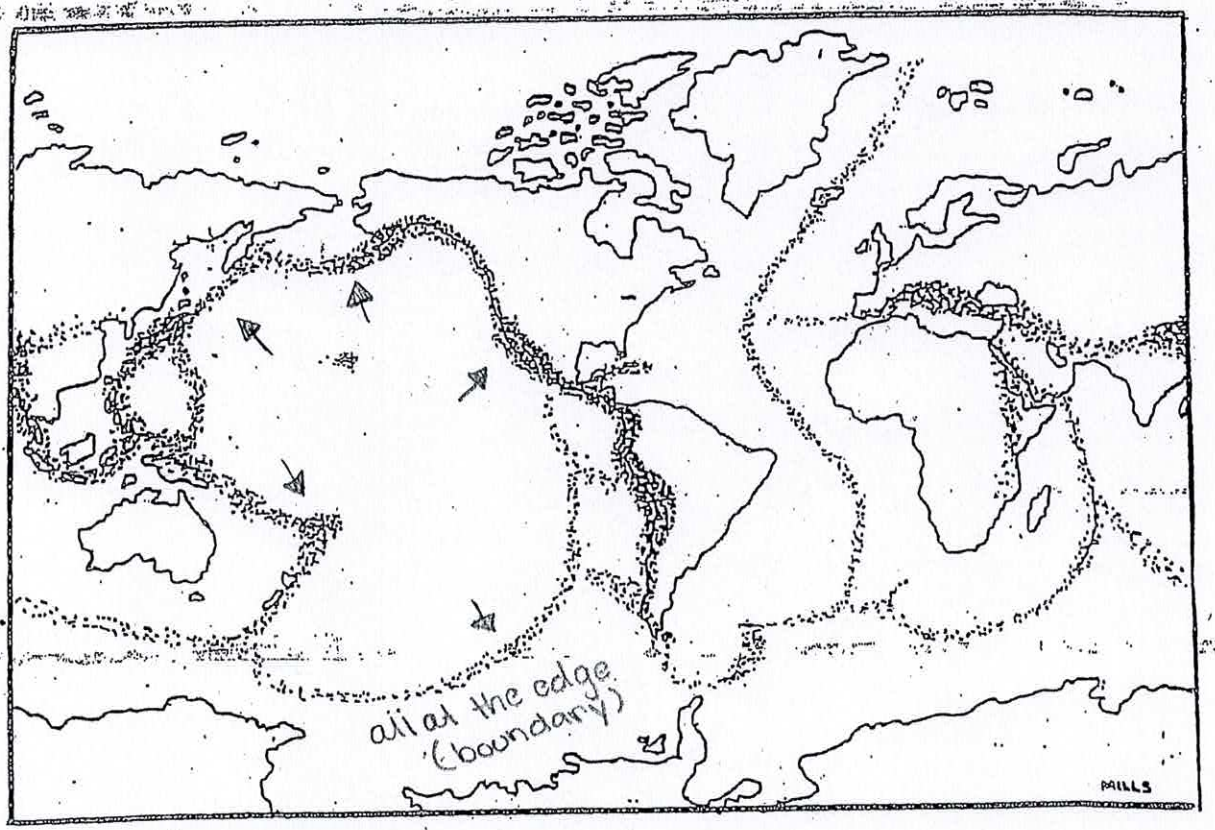
The resulting convection of this material in the mantle less lithospheric plates across the surface of Earth. Remember, continents are just riding on the lithospheric plates like packages on a conveyor belt that moves approx. 3 cm/yr!

III. EARTHQUAKES

A. Seismology - the branch of science that studies earthquakes.

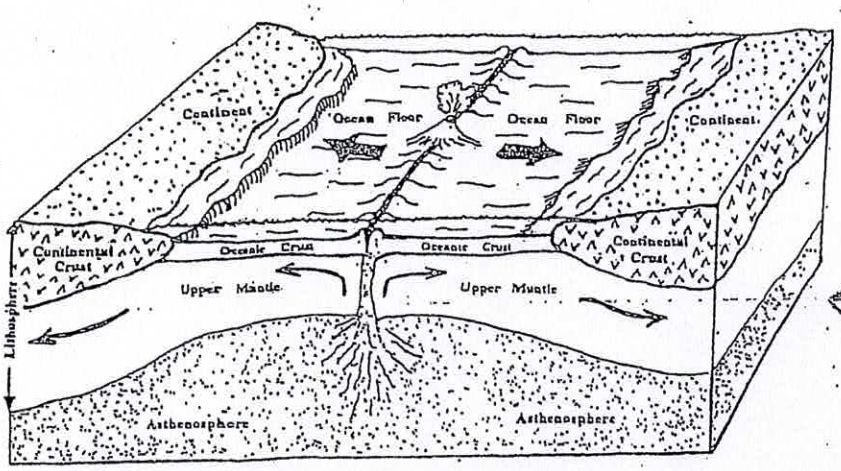
ba-kyah

B. Earthquake Regions on Earth



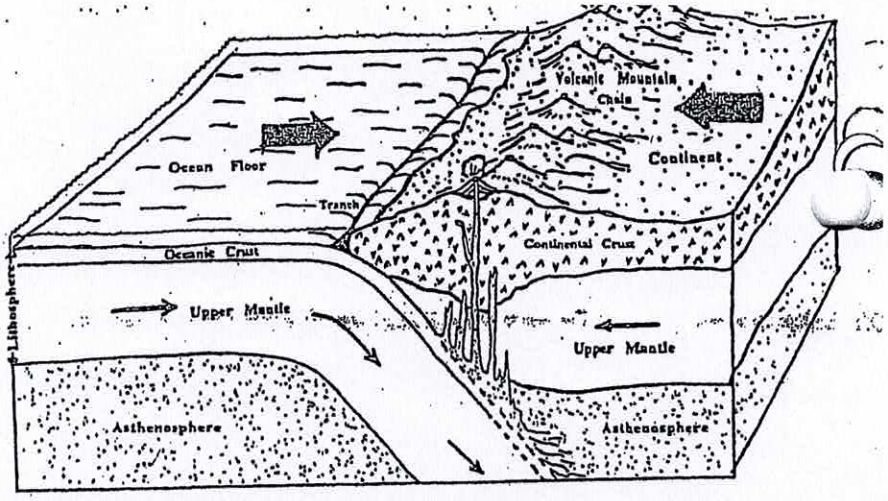
C. Causes of Earthquakes – Sudden movement of Earth's crust at plate boundaries and faults.

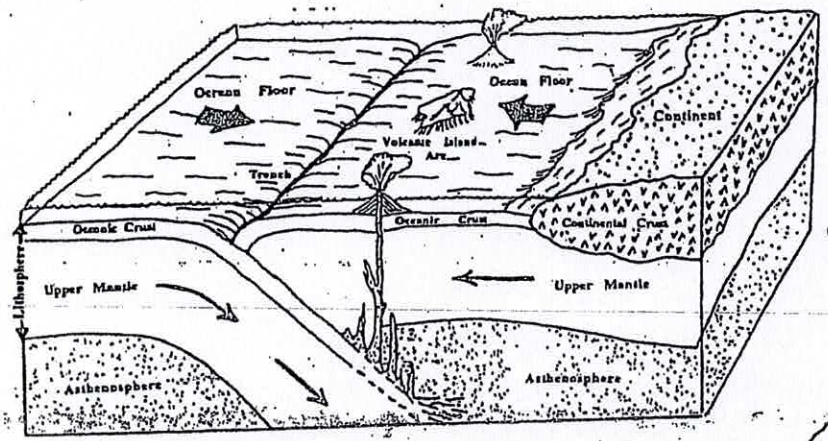
1. Plate Boundaries



← Divergent Boundaries
Usually minor quakes
Shallow

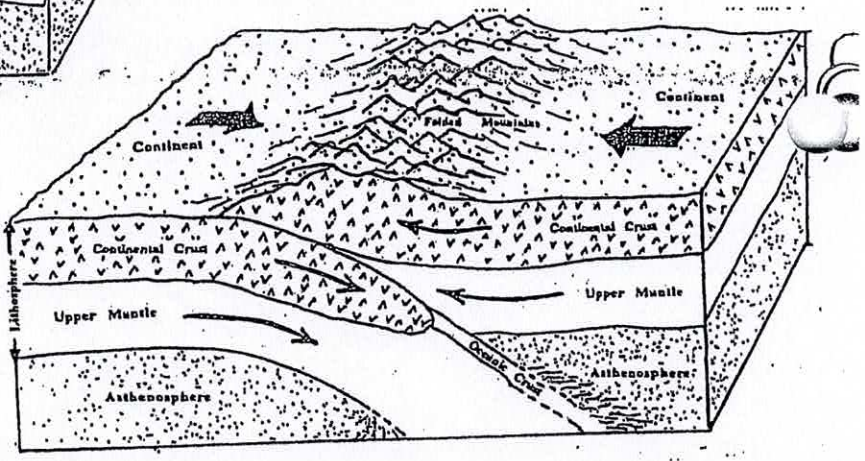
convergent boundary
ocean - continent
strong / deep quakes

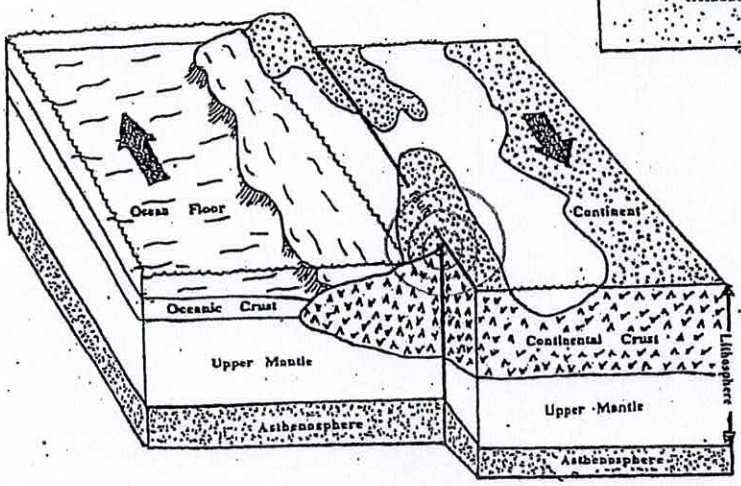




Convergent Boundary

Convergent Boundary

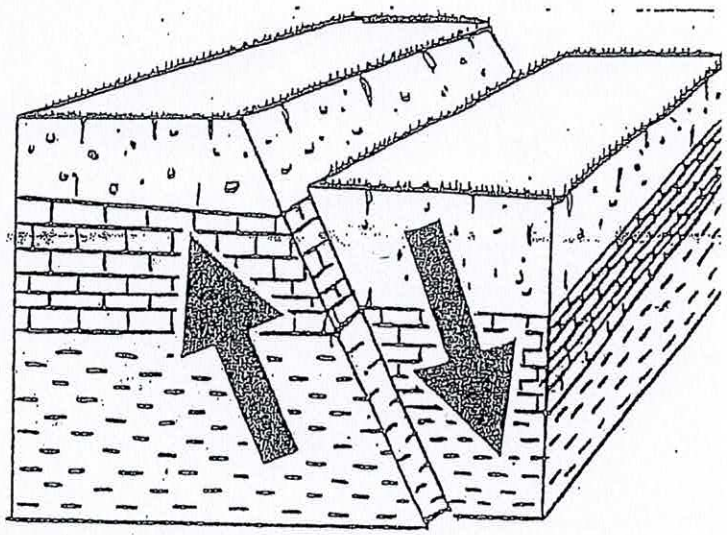




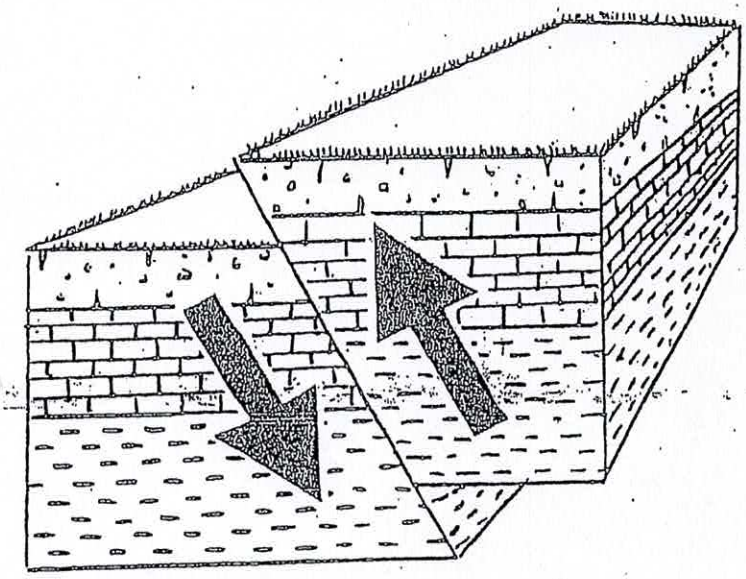
transform boundary

strike - slip fault
moderate / shallow quak

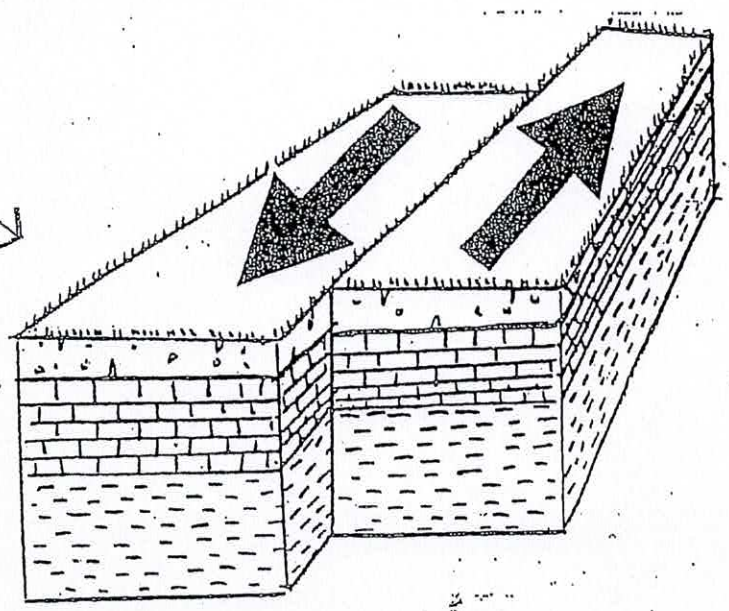
2. Faults



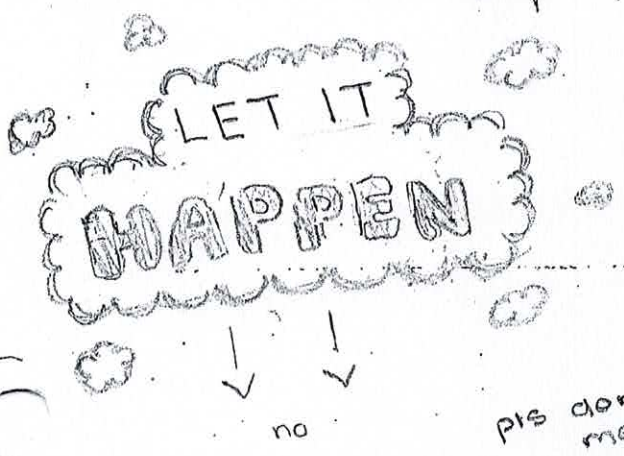
Normal



Reverse

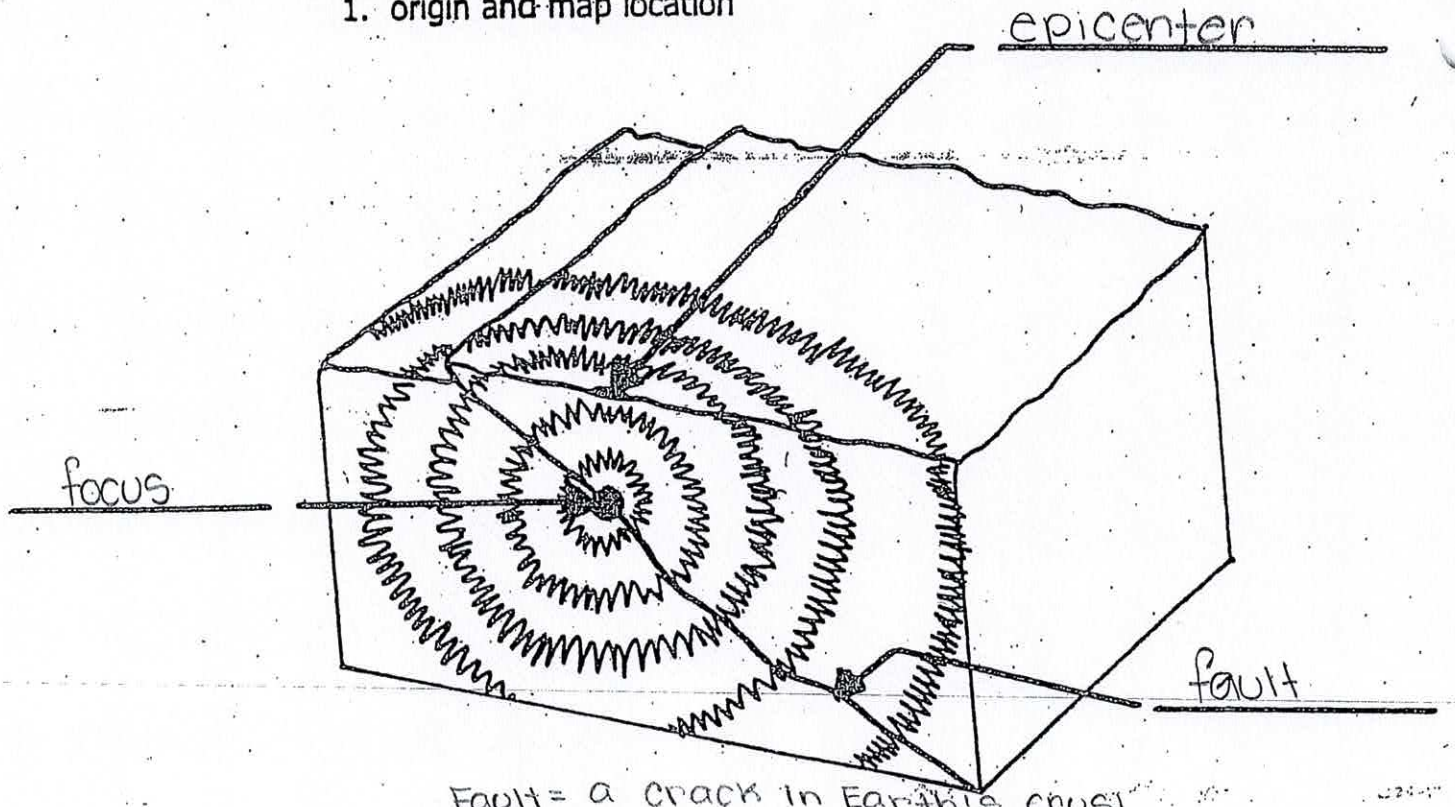


Strike-slip



D. Earthquake Waves

1. origin and map location



Fault = a crack in Earth's crust

Focus = point beneath Earth's surface where fault movement releases seismic waves (energy)

Epicenter = point on Earth's surface directly above the focus

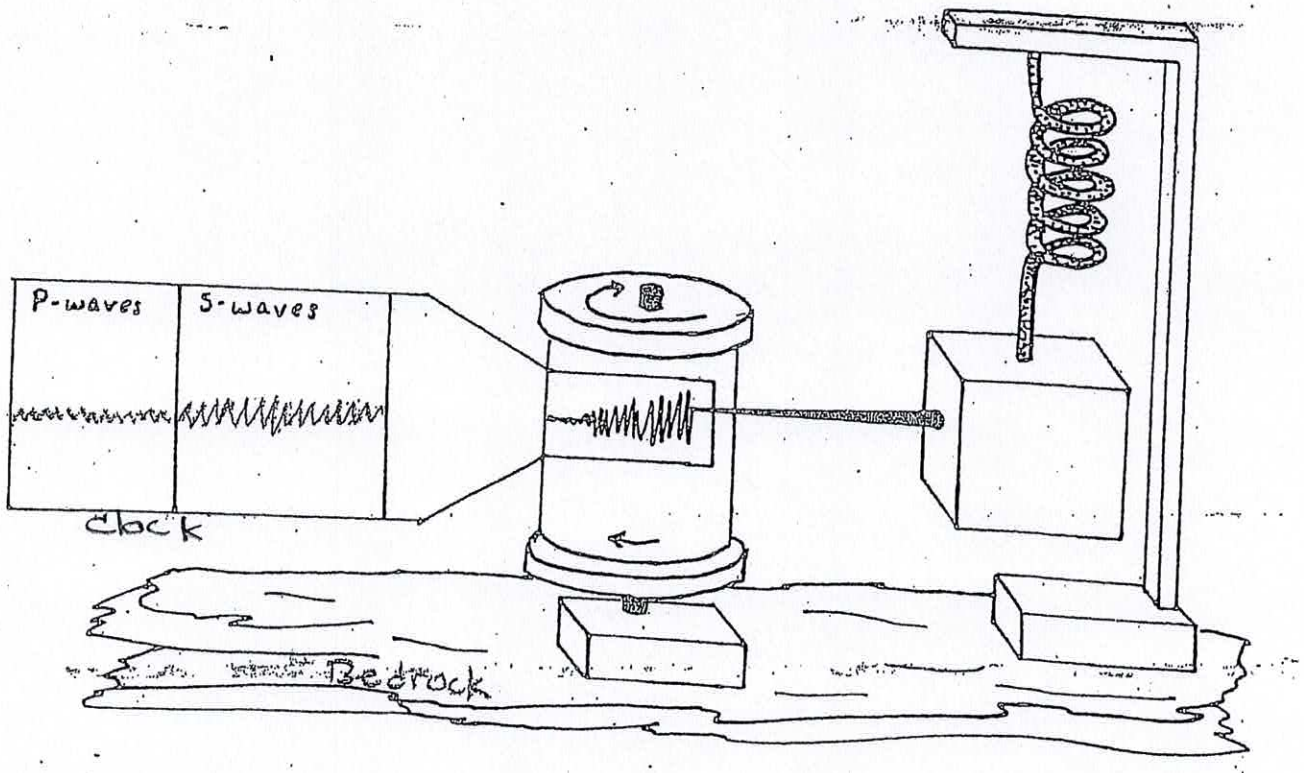
2. Types:

	Proper Name	Travel Speed
P waves	Primary	6 mps
S waves	secondary	4 mps

P waves: faster, weaker, liquids & solids

S waves: slower, stronger, only solids

3. Seismograph - measures and records earthquake waves.



S-wave
- slower
- stronger
- solids

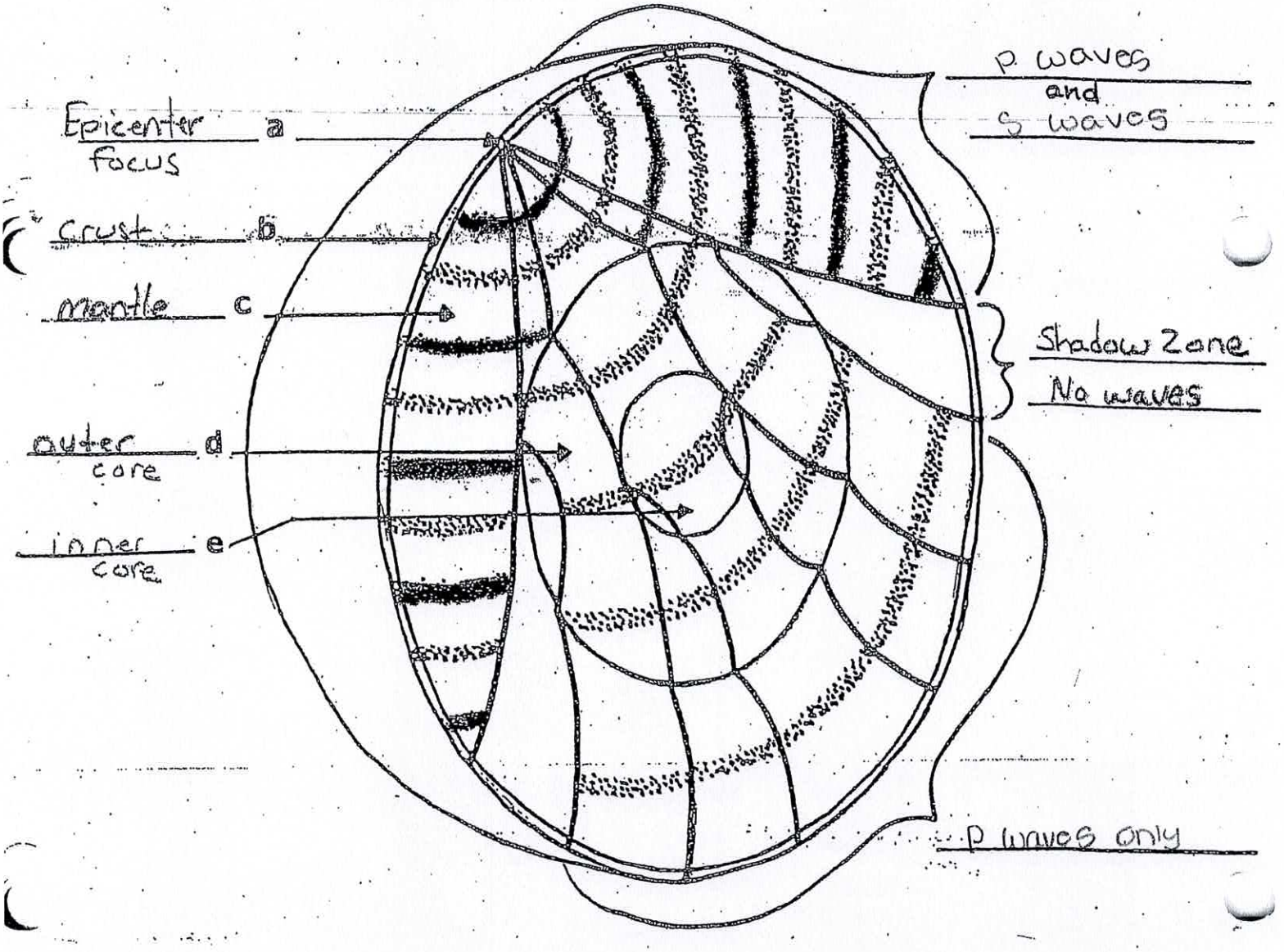
F. Earthquake Waves and Earth's Interior

1. Analysis of seismic waves (P and S waves) has led scientists to infer the interior structure of Earth.
2. a. P waves travel through Solids and liquids.

   b. S waves can only travel through Solids.
3. Earth's structure/interior is divided into the crust, mantle, outer core and inner core.
4.

Key
P waves =
S waves =

Reference Table
Page 11



G. Measuring an Earthquake

1. Richter scale - a scale used to express the strength or energy an earthquake releases by assigning a number from 1 to 10. (Each of the numerical steps represents a ten-fold increase in the amount of energy; for example, a reading of 3 indicates 10 times more energy than a reading of 2)

EARTHQUAKE OCCURANCES

RICHTER SCALE	NUMBER EXPECTED PER YEAR
1.0 to 3.9	> 100 000
4.0 to 4.9	6 200
5.0 to 5.9	800
6.0 to 6.9	120
7.0 to 7.9	20
8.0 to 8.9	<1

2. Mercalli Scale - a scale used to show the damage caused by an earthquake by assigning a number from I to XII (1 to

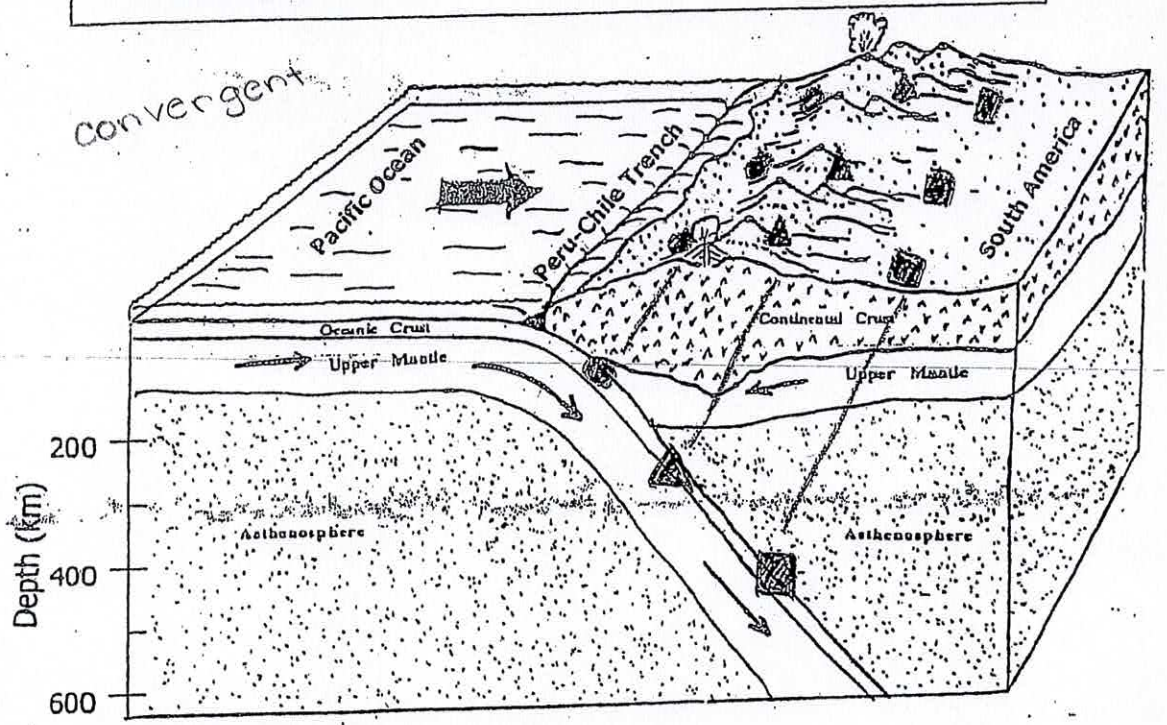
SOME STEPS IN THE MERCALLI SCALE OF EARTHQUAKE DAMAGE	
STEP	EXTENT OF DAMAGE
I	The earthquake is felt by only a few people near the epicenter.
III	The earthquake is felt in buildings, usually only upper floors.
V	Windows and fragile objects are broken.
VII	People run out of buildings, some masonry breaks.
IX	Cracks form in the ground, and all buildings are damaged.
XII	Objects are thrown into the air; all structures are destroyed.

H. Earthquakes tell us about Earth's surface movement

Focus = the depth at which an earthquake originates

KEY

- ⊙ Shallow = within 75 km of Earth's surface
- △ Intermediate = 75 to 300 km below Earth's surface
- □ Deep = 300 to 700 km below Earth's surface

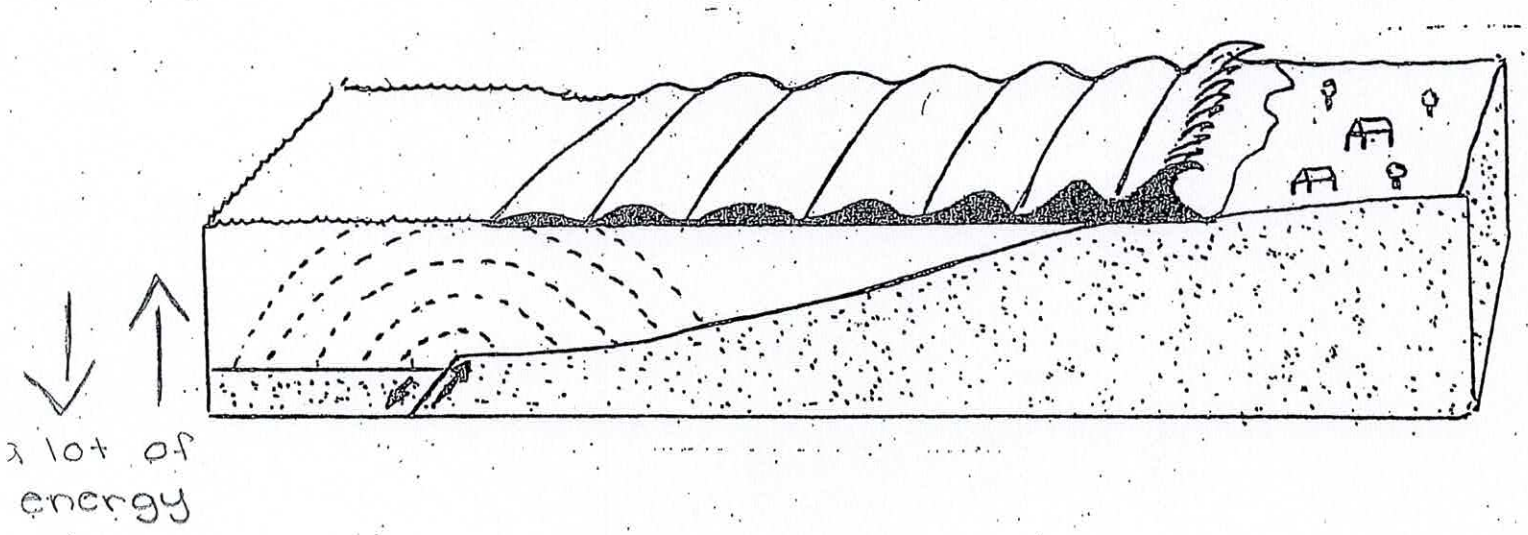


I. Earthquakes cause other disasters

tsunami = gigantic sea waves.

Characteristics: speed = 400-500 mph

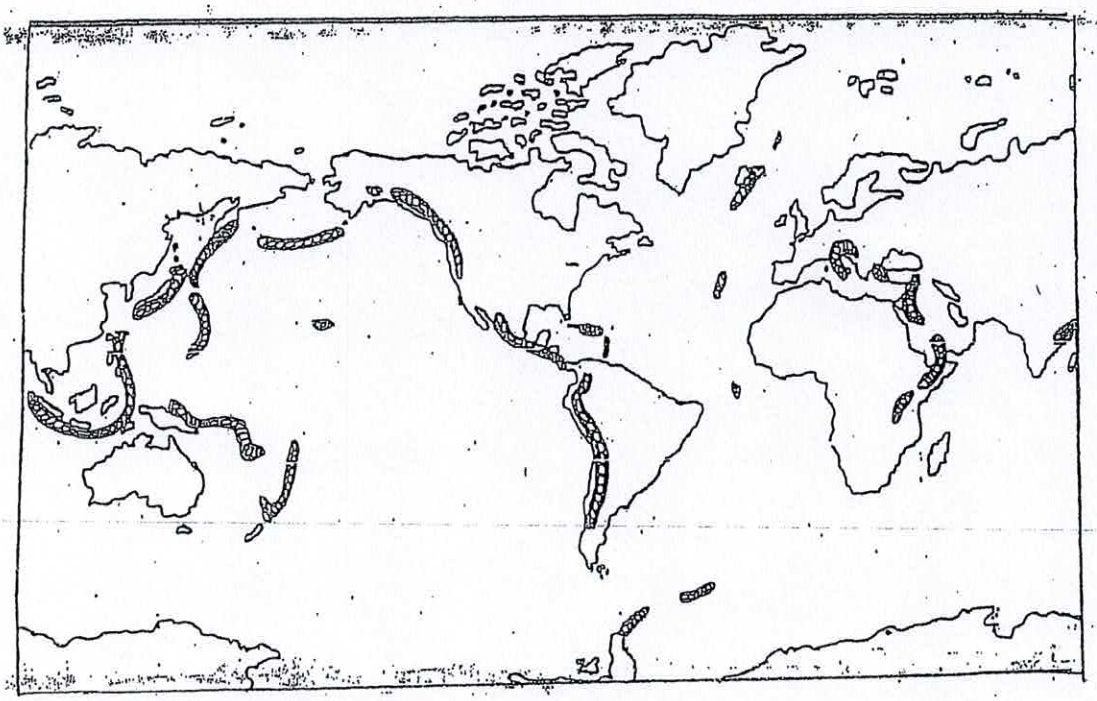
height = 50-100 feet



a lot of energy

IV. VOLCANOES – a mountain or hill having a vent through which lava or gas can escape or erupt

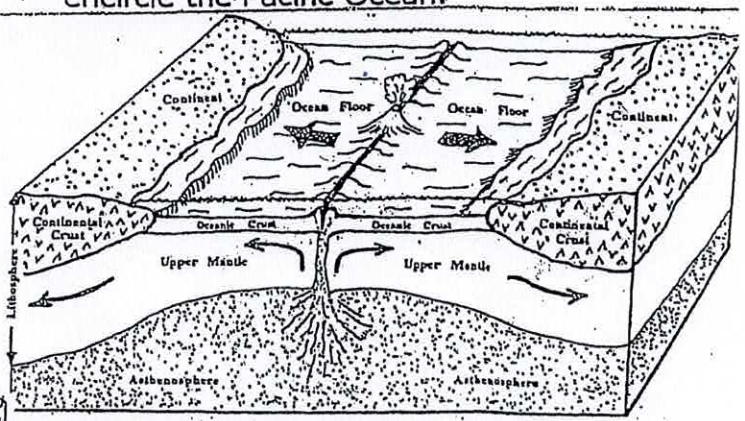
A. Volcanic Regions on Earth



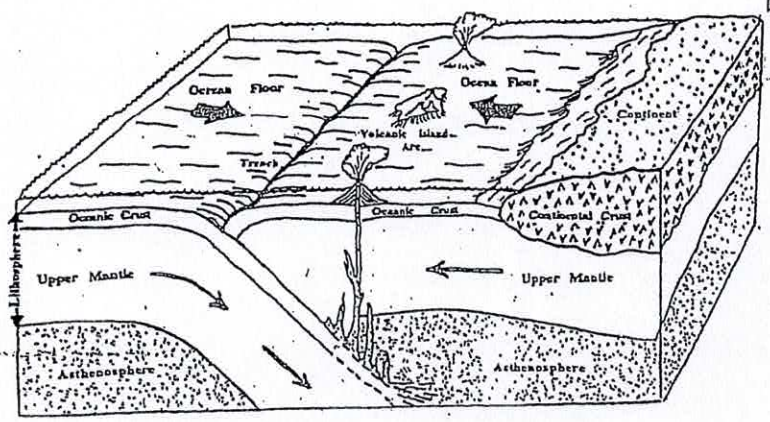
Ring of Fire = region of volcanoes that encircle the Pacific Ocean.

C. Causes of Volcanic Activity

1. Plate Boundaries

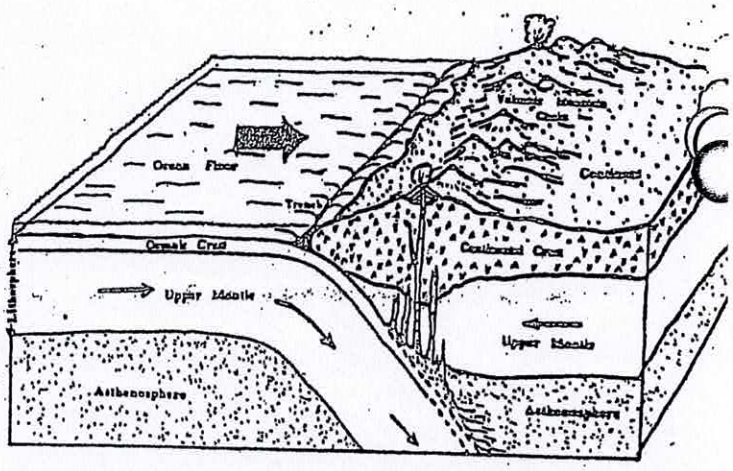


Divergent



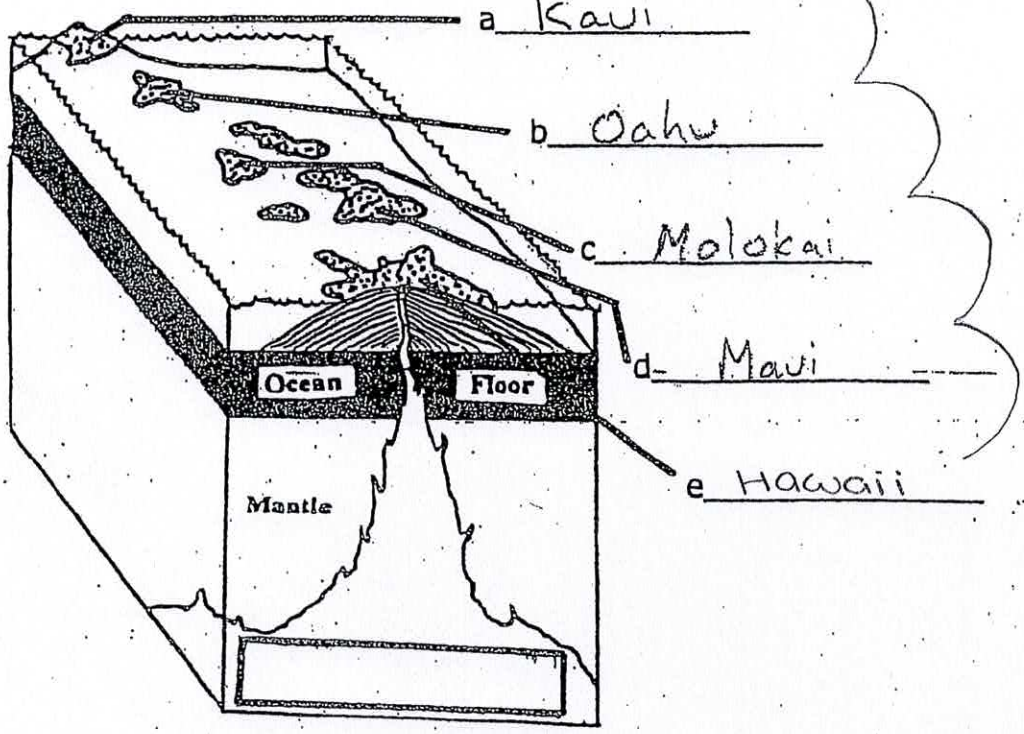
Convergent

Transform

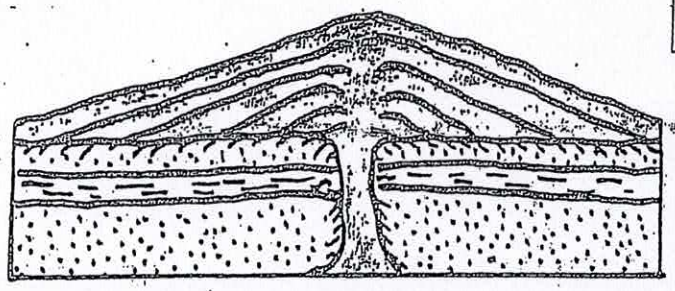


2. Hot Spots — region on earth where volcanos are fed by a relatively hotter mantle

Hawaiian Islands

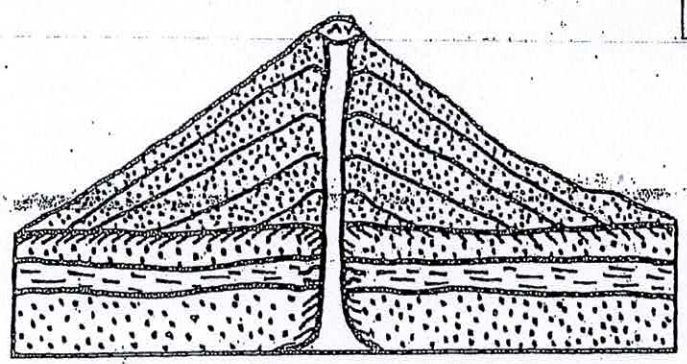


C. Types of Volcanoes



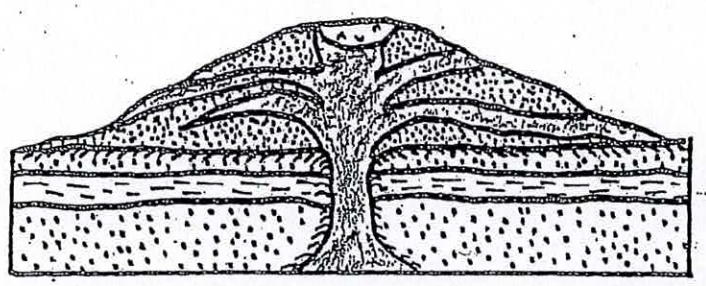
Shield Cone

- nonexplosive eruptions
- built from repeated lava flows
- gentle slopes
- example Mauna Loa



Cinder Cone

- explosive eruptions
- built from tephra (lava is blasted into the air and solidifies as it falls to the ground as ash or cinders)
- steep slopes
- example Paricutin

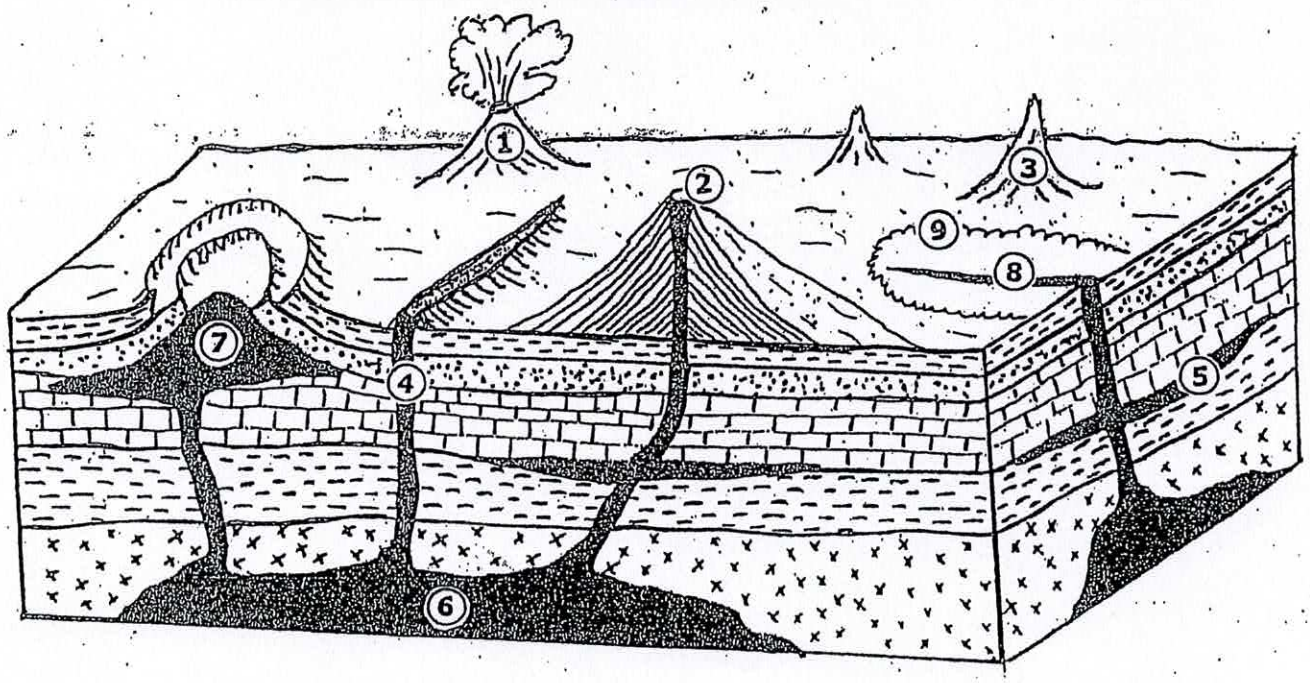


composite Cone

- repeated nonexplosive and explosive eruptions
- built from alternating layers of lava and tephra
- moderate slopes
- example Mt. Fuji

D. Volcanic Features

When magma cools below Earth's surface, the resulting igneous rock is called an Igneous intrusion.



1. Volcano - cone-shaped mountain built of lava and/or volcanic ash
2. Crater - steep walled depression at the top of a volcanic mountain; central vent
3. Neck - solid igneous rock core that remains from an extinct volcano after many years of erosion
4. Dike - forms when magma squeezes into vertical cracks in the surrounding rock layers; vertical igneous intrusion. Erosion of the softer surface rock exposes the dike, which appears as a wall
5. Sill - forms when magma squeezes into horizontal cracks in the surrounding rock
6. Batholith - large deep igneous intrusion
7. Laccolith - dome-like intrusion that often pushes rock layers upward forming mountains. Erosion of the surface rock can expose this intrusion
8. Fissure - long cracks at Earth's surface from which lava flows
9. lava flow - lava on Earth's surface may form a plain or plateau