

## CHAPTER 3 TECTONICS

Vatnajökull Glacier- Iceland- Fire and Ice

Density = Mass/Volume

**The Earth is density stratified:** each deeper layer is more dense than the layers above.

Densities: Water = 1 g/cc or a specific gravity of 1

Granite = 2.7 g/cc or 2.7 G

Basalt = 3 g/cc or 3 G

Drilling Records

Land- Kola Peninsula-1992-12,063m (7.5 miles)

(T there = 245 degrees C (or 473 degrees F) Pressure squeezed hole closed

Ocean Joides Resolution-1991-

2 km (1.2 miles) of seafloor beneath 2.5 km (1.6 mi.) of seawater

From density stratification, we can assume that the Earth is differentiated or layered.

Evidence For Layering- Earthquake Waves

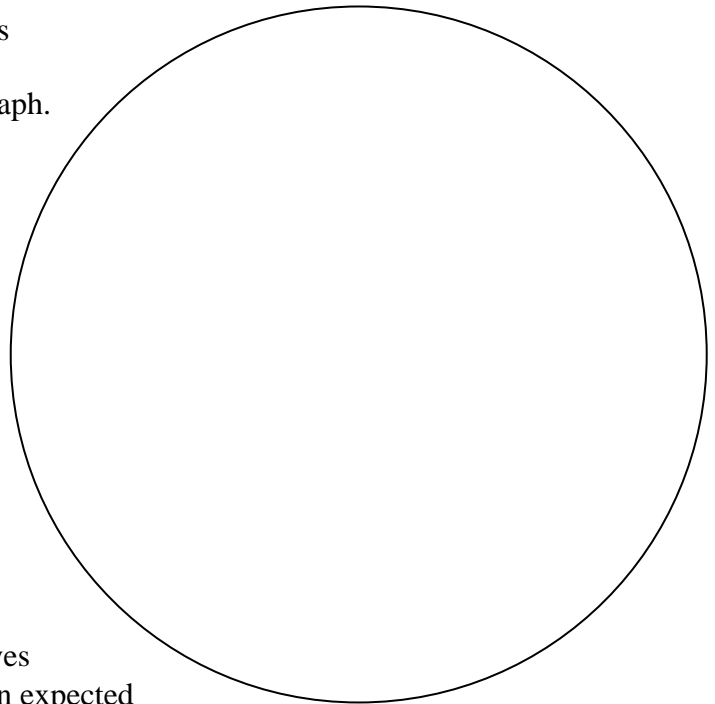
P Waves-Primary-Fastest Waves

S Waves-Secondary-do not travel through liquids

These seismic waves are recorded on a seismograph.

Shadow Zones

- band where earthquake waves are absent



Richard Oldham (1900)- first identified P/S Waves

→ noticed that the waves arrived sooner than expected

→ noticed that no S waves passed through the deepest parts of the Earth

Discovered S wave Shadow Zone

Inge Lehmann- discovered P Wave Shadow Zone

→ P waves were slower than expected

→ Further indicates pressure of layering in the Earth

By the 1960s, a new series of seismographs were in place world wide to study earthquakes.

March 27, 1964 Alaska earthquake

Time = 4.5 minutes of shaking

Anchorage moved 2 meters, sward 14m (46feet)

Damage = 750 million

Deaths = 115

Classification of the layers of the Earth  
(enter diagram)

Crust

1. Basaltic-oceanic-2.9G
2. Granitic- continental-2.7 G

Mantle

Ultramatic-4.5G

Core

- >Metallic: Fe, Ni, Si, S
- > Density- 13G

Lithosphere

>includes the crusts

>down to 100-200km (6m/25 mi.)

Asthenosphere

> down to 350-650 km (220-400 miles)

Lower Mantle

> more dense, solid

Core

> outer

➤ inner

Isostatic Equilibrium

Buoyancy of the Earth

Buoyancy is the ability of an object to float in a fluid by displacing a volume of that fluid equal in weight to the floating object's own weight.

## Figure 3.6

Isostatic Equilibrium-“equal standing”

Isostatic adjustments enhance erosion (Figure 3.7)

Elastic Rebound Theory

Brittle and Ductile

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Near surface    At Depth

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Faulting          Folding

### **Age Debate of Earth**

Ussher-4004 BC, Oct 21, 9AM

Lord Kelvin- rate of cooling of the Earth- 80 million (not linear)

- Problem- earth's heat is from the Radioactive Decay

Hutton- Principle of Uniformity or Uniformitarianism

Old View- Catastrophic- Noah's Ark

### Continental Drift- Wegener-1915

Da Vinci, Bacon- fit of the continents

Evidence: 1. Glassopteris          3. Glaciers  
                 2. Rocks                  4. Climate

Pangea, Panthalassa

Wadati-1935- earthquakes/ volcanoes may be associated with the continental drift

Benioff-1940-revealed Pacific Ring of Fire

### Hess-1960s- Seafloor Spreading

>Ocean Crust is young (less than 180 million)

>Youngest at M.O.L., where creation takes place

>Destruction occurs at Subduction Zone

### Plate Tectonics- J. Tuzo Wilson-1965

Tekton- builder

Plate Motion is caused by:

1. Plates form and slide away from the spreading centers (Mid-Ocean Ridges)
2. Plates are pulled downward into their mantle by their cool, dense leading edge

Now for the Proof: 1968- Glomar Challenger- obtained sea cores to help prove theory.

Plate Boundaries

1. Divergent
2. Convergent
3. Transform

## Confirmation of Plate Tectonics

### 1. Paleomagnetism- 1963-Matthews, Vine, Matthews

- Prove seafloor spreading
- Apparent Polar wandering helped prove continents moved

### 2. Hot Spots and Mantle Planes

### 3. Age of Ocean Sediments

Tectonics- Wilson Cycle-Fig. 3.36