

Lecture 2 - A tour of the ocean floor..

A computer generated view from the Grand Bahama Bank, across the Atlantic ocean

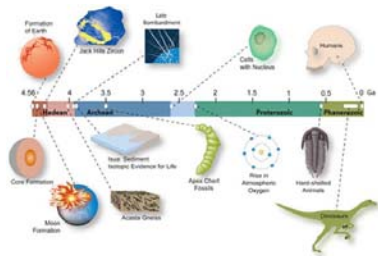
Credit - Nat geo "Drain the Ocean".



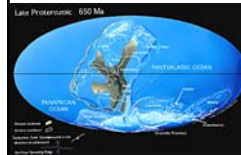
The story so far...

1. A distant universe died, and ours began with a bang (an expansion, not an explosion)
2. Out of a cloud of dust - the sun formed
3. Within the sun, energy generated thru nuclear fusion
4. Orbiting planets form, discriminated by composition
5. Earth - forms thru sequential accretion, mostly rock, some CHON compounds
6. Partial melting creates a molten surface, thick atmosphere keeps earth molten and comets dissolve into the surface layer
7. Earth cools, as radioactive decay in the core diminishes
8. Crust forms, volcanic eruptions release magma to surface
9. Water emerges thru the crust and accumulates
10. First as water vapor, then condensing back to the surface as hot rain.....

A timeline...

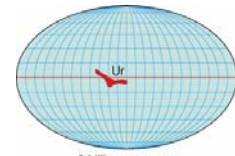


The World Ocean today



The World Ocean 650 Ma

The formation of the first world ocean -



3 billion years ago



Sir Francis Bacon  
1561 - 1626

The jigsaw fit...



Alfred Wegner - 1912 lecture proposed the concept of [continental drift](#)

Frank B. Taylor - The Wallace of this story...

Bathymetry - The study of the ocean floor.

1st Method - 85 B.C - using a long line and a rock.

First innovation - 1870 - a winch was added.

Major event - sinking of the Titanic - stimulated further research....



Some related nautical terms....

A fathom - six feet

A league ( as in 20,000) three miles....

Deepest point in the ocean ?

Marianas Trench -35, 838 ft.



The Sea Floor - First mapped in its entirety by Heezen and Tharp. Circa 1974



Plate tectonics:  
Earth's  
lithosphere

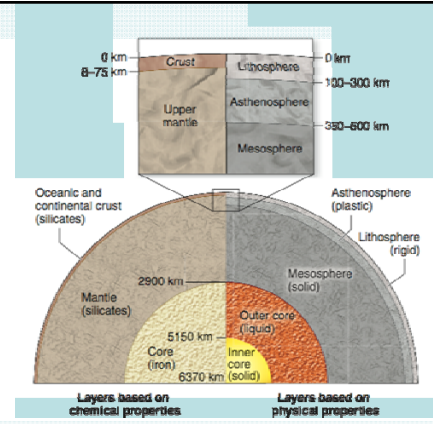
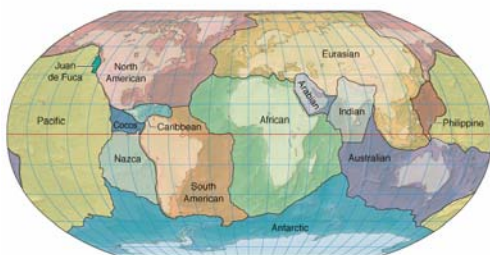
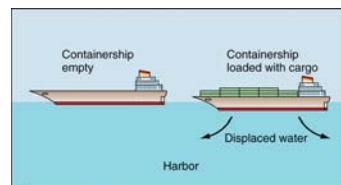


Plate tectonics: Refers to the origins, history, and movements of the dozen or so large and rigid "segments" of Earth's lithosphere.



Principles of plate tectonics:

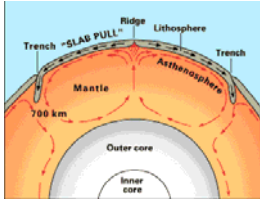
The crust "floats" on the molten magma



Principles of buoyancy and displacement

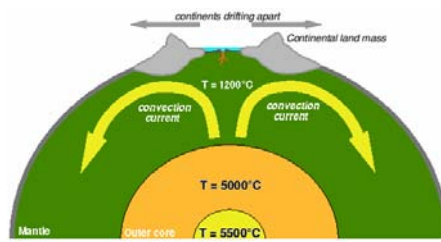
Oceanic crust is heavier than continental crust, so the oceanic crust floats a little deeper.

Principles of plate tectonics: Convection currents

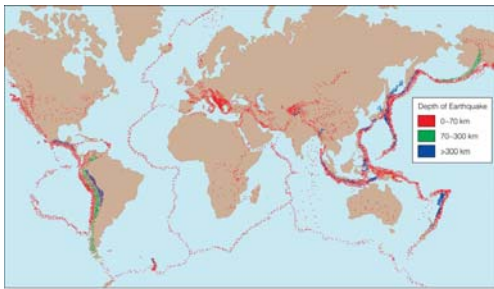


Convection currents in the asthenosphere propel the movement of the lithosphere

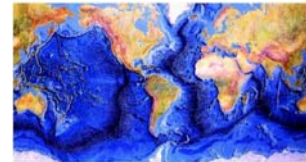
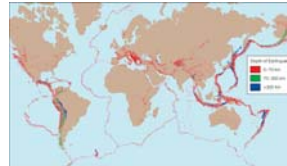
Principles of plate tectonics: Convection currents



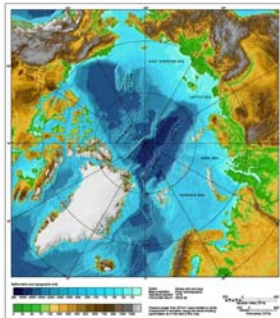
Compiling the evidence to support the theory  
Locations of some 30,000 earthquakes - any patterns ?



Compiling the evidence to support the theory  
Locations of some 30,000 earthquakes - any patterns ?



Thermal maps show that oceanic temps are higher over the ridges..



Clues in the sediment layer..

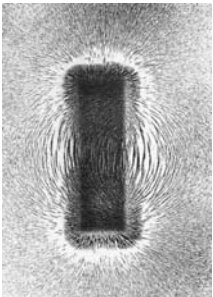
Pillow basalt - forms at high temps - found along the ridges.



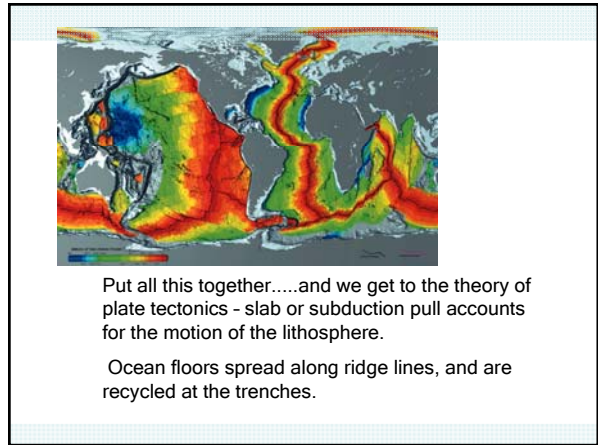
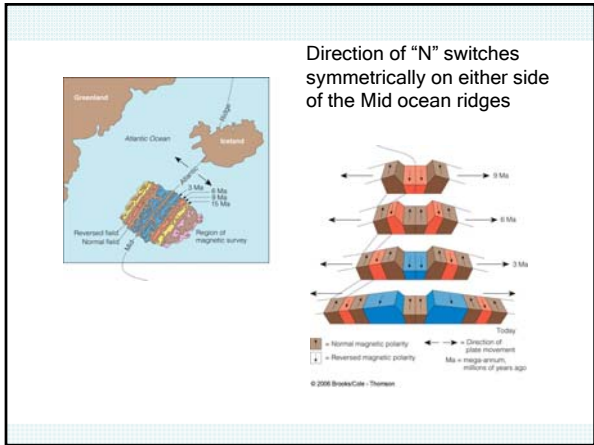
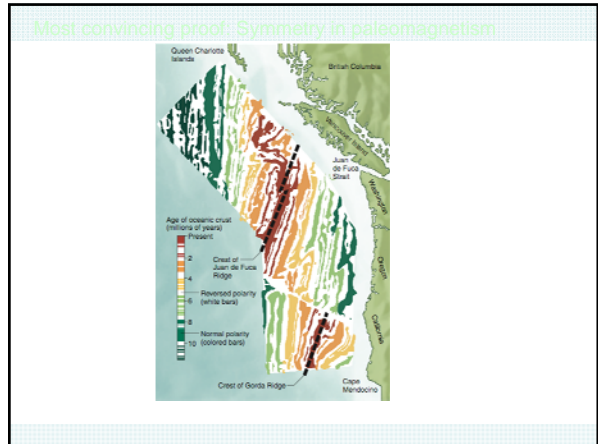
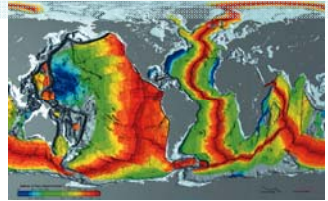
Also - sediment layers deepen  
- age of crust increases

Best evidence -

Paleomagnetism and a really neat pattern



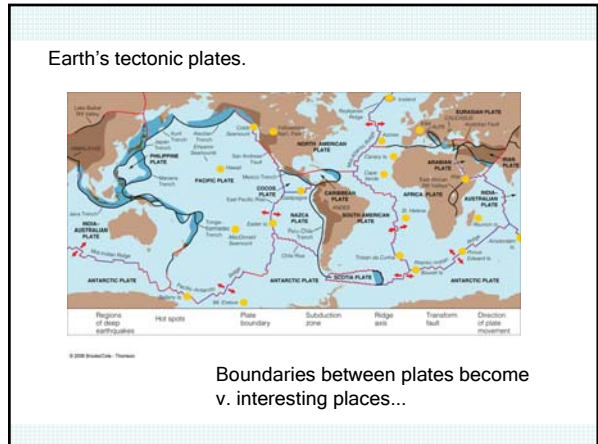
© 2008 Brooks/Cole - Thomson

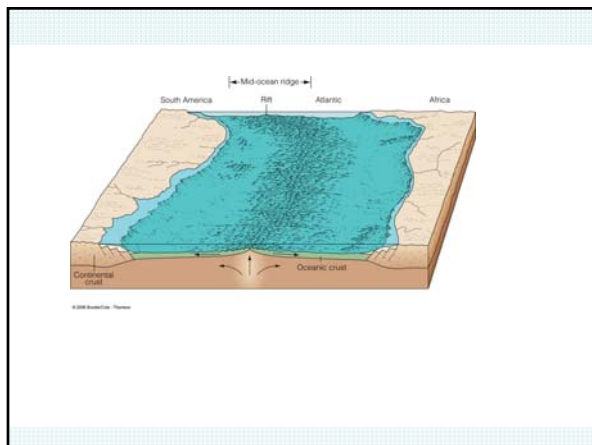
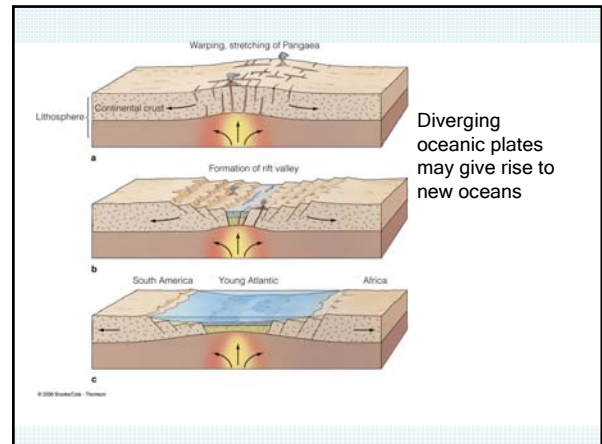
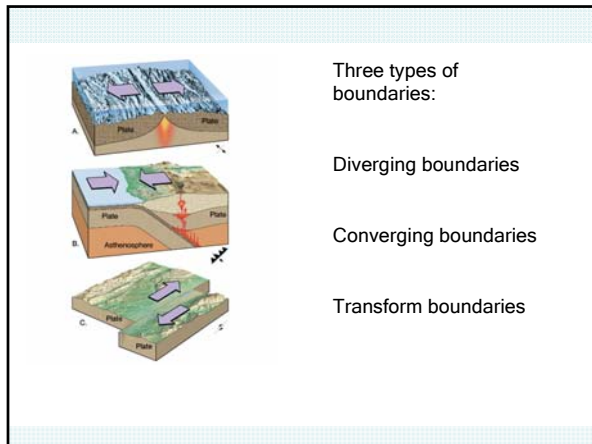



Primary forces of movement:

- Outward push from the ridge
- Downward pull at the leading edge of the descending plate

[Animation](#)





### The Red Sea

### 3. Diverging plates on land

### How I spent my summer...



Why California is such an exciting place geologically speaking..

A textbook transform plate boundary

North American and Pacific plates shear by each other.....

Northridge earthquake

Asian Tsunami

Earth's tectonic plates.

Boundaries between plates become v. interesting places...

North and South Islands of New Zealand.

Mt Ruapehu

Southern alps

North and South Islands of New Zealand.

The theory of plate tectonics explains what lies below .....

Half the earth's surface is below 3000 meters of sea...

Dark, deep, hot vents of boiling water, dangerous gases.....

We'll explore this after the break..

A black smoker....

400 C , 3000m below sea level.....