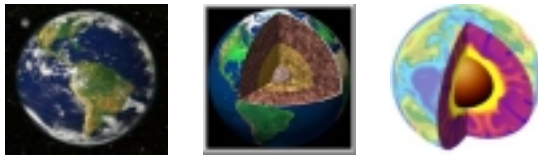


The Earth

R ~ 6400 km



Structure of the Earth

Crust 2.8 gm/cc

continental 50 km

oceanic 5 km

Granite/Basalt Rocks
(solid)

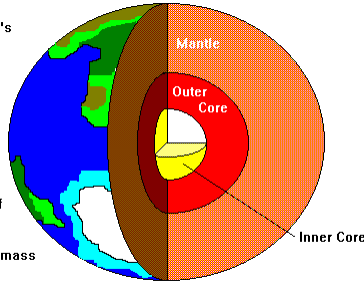
Atmosphere:
1/1,000,000 of Earth's
mass

Oceans: 2/10,000 of
Earth's mass

Crust: 1/250 of
Earth's mass

Mantle: 2/3 of
Earth's mass, 5/6 of
volume

Core: 1/3 of Earth's mass
1/6 of volume

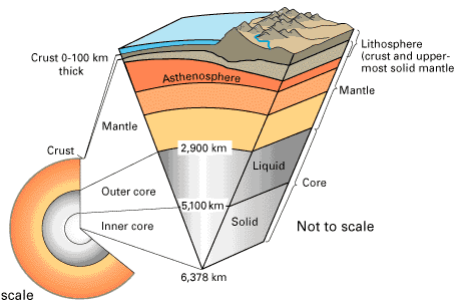


Mantle 4.5 gm/cc

upper 800 km

lower 2000 km

Oxygen, Silicon,
Magnesium, & Iron
(plastic-like)



Core 12.9 gm/cc

outer liquid 2100 km

inner solid 1400 km

Iron and Nickel

Deepest Mine (S.A.) 3.4 km, deepest hole (Texas) 7.7 km

How do we know the structure within the Earth?

Seismic Waves (vibrations)

Earthquakes - sudden movement of the earth

Explosions

Seismograph records

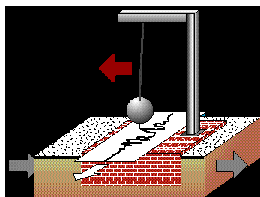
Earth vibrations

amplitude, time

type

transverse

longitudinal



Different layers, velocities

⇒ refraction

liquids do not transmit

transverse waves

4 types of seismic waves

Body Waves - through Earth

P (primary)

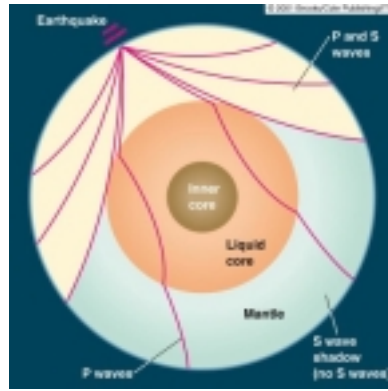
longitudinal, fast

S (secondary)

transverse, slow

Surface Waves

- L (Love) - sideways
- R (Rayleigh) - elliptical

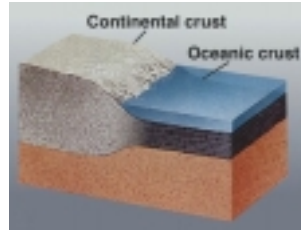
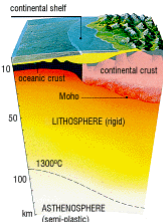


06-02

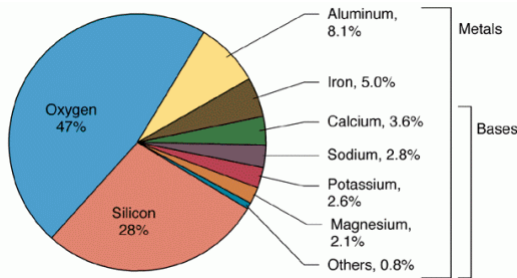
ratio Body/Surface amplitude
distinguishes earthquakes from nuclear explosions

CRUST

density 2.8 gm/cc



common elements
by weight



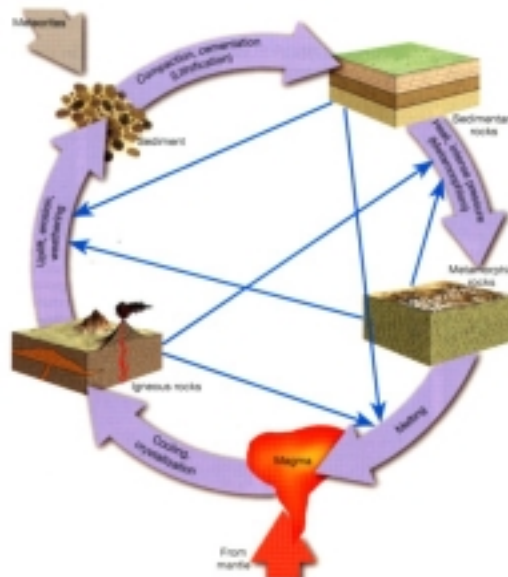
Rock - heterogeneous
(non-uniform) aggregate
of minerals

Mineral - naturally occurring
homogeneous
inorganic compound
definite crystal structure
characteristic properties
color, density, hardness

Types of Rocks

IGNEOUS

most common
youngest at surface
granite, basalt
formed from molten matter
oldest inside

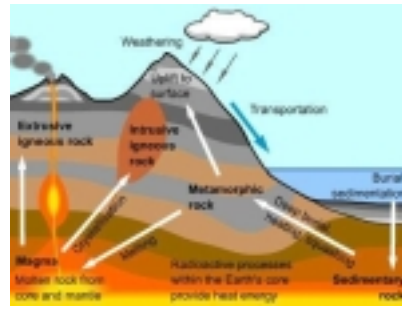


SEDIMENTARY

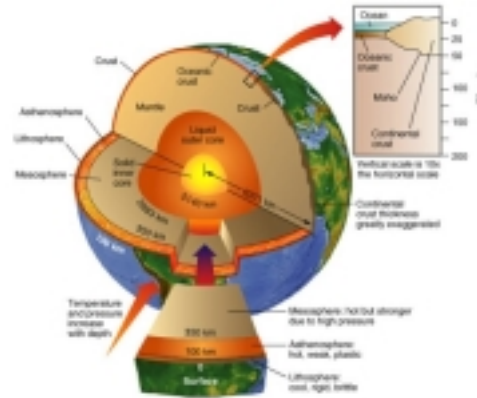
deposits of weathered eroded rocks, compressed gypsum, clay, quartz

METAMORPHIC

changed, recrystallized by heat and pressure in crust without melting



MANTLE 4.5 gm/cc
sharp boundary at crust
dense silicate materials
rich in Mg Fe
multiple layers
mostly solid
close to melting



Outer CORE
liquid - no S waves
molten Fe + Ni Co S Si

Dynamo Effect

heat flow + rotation
⇒ magnetic field

Inner CORE 12.9 gm/cc
solid, near melting, P 3.5 million atmospheres, T ~ 5000°C

VOLCANOS

>500 in last 400 yr
show dynamic (changing)
nature of Earth's surface

Krakatoa in Indonesia

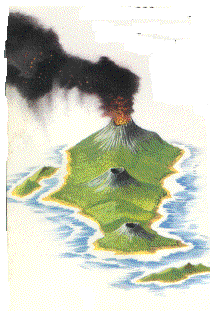
volcanic island
dormant 200 years
exploded in 1883
heard in Australia
> 5000 km away

17 km³ rock/pumice into air
destroyed 2/3 of island
tidal wave

drowned 36,000 people

Volcanic Activity

most widespread after
mountain formation



MAGMA - hot material
below surface, plastic

LAVA - rises,
becomes liquid
flows or explodes out



Old View - static Earth
continents and oceans fixed

Modern View - dynamic
Plate Tectonics

FOSSILS

remains of organisms
in geological past
preserved in

sedimentary rocks
recognizable layers
radioactive dating
provide time record
life on Earth

PHANEROZOIC EON

CAMBRIAN PERIOD

570 MYA

Million Years Ago

fossils visible to
naked eye

PRECAMBRIAN EON

3800 MYA

microscopic fossils

Age of Earth 4.6×10^9 yr

