

200 yrs ago: James Hutton ~ Father of modern geology  
He believed that rocks were made during an EXTREMELY SLOW PROCESS. In Scotland, he noticed two layers of rock  $\perp$  (perpendicular). This must have taken MILLIONS of years. **THEORY**  
This theory became the guide to the past.

200 +/- yrs ago: Lord Kelvin ~ He believed the Earth was a ball of molten rock (miles deep @  $8000^{\circ}\text{F}$  - same as surface of the sun). He used THERMODYNAMICS to estimate that the Earth would take 20 million years to cool. Radioactive elements (uranium, potassium, & thorium) actually kept the Earth warm for a lot longer. (4.5 Billion years old)

4.5 Billion yrs ago: Most widely accepted age of the Earth

- High  $T \uparrow$  = molten rock (hot lava ocean)
- Radioactivity  $\downarrow$  = Earth began its cooling process.
- This was a transformation from a molten rock Earth to a water world.
- Pillow lava (forms deep under  $\text{H}_2\text{O}$ ) found in Africa  
**prior under water volcano**

4.4 Billion yrs ago: Gradual cooling of the Earth's core and the Earth's surface solidifies into volcanic rock. Crystals were a fingerprint (evidence/clue) for  $\text{H}_2\text{O}$  molecules. **THEORY** meteorites impacted the Earth. (meteorites held 5%  $\text{H}_2\text{O}$ ). Oceans are beginning to form, &  $\text{CO}_2$  is released.

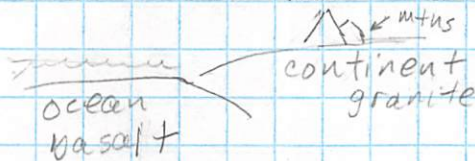
4.1 Billion yrs ago: The 5%  $\text{H}_2\text{O}$  evaporated into clouds. It rained for millions of yrs. Oceans were formed.  
2/3 of Earth's surface

### 4.0 Billion yrs ago:

- 90% vast ocean w/ volcanic islands
- 200°F
- thick red CO<sub>2</sub> skies (dense atmosphere had so much pressure it could crush a human.)
- creation of continents (made up of granite)

### 3.5 Billion yrs ago:

- S. Africa is the oldest part of Earth
- continental crusts are made of granite (less dense)
- Ocean crusts are made of basalt (more dense)



### 3.4 - 2.5 Billion yrs ago:

- Western Australia → coastlines brought life (single cell organisms)
- \* Stromatolites → lived off of sunlight
- thru photosynthesis → filled the atmosphere w/ O<sub>2</sub> (20 million billion tons)
- start of our Rock Record → fossils / date

### 2.2 - 1.5 Billion yrs ago:

- Oxygenation "Blue Planet"
- \* Evidence of fossils on N. America & England (Trilobite)
- Continents were on the move ???
- Alfred Wegener ~ Plate tectonics → continental drift theory
- \* Earth's crust is constantly being recycled

fresh H<sub>2</sub>O?

perioxides

### 1.5 - 1.0 Billion yrs ago:

Desert-like (lifeless) single celled organisms in the oceans  
super continent → Rhodania

### 700 million yrs ago:

- "snow ball Earth"
- ↓ T -40°F / ocean ice 1 mile deep
- mass extinction event (left <sup>green</sup> bacteria & algae)

650 - 550 million yrs ago:

- Heat inside the Earth was building
- CO<sub>2</sub> ↑ from eruptions made Greenhouse effect
- ↳ Rhodania broke up
- Highest levels O<sub>2</sub> to date ∴ brought to life in the form of primitive, complex, & dangerous life forms
- Fossils were evidence of diversity (teeth, eyes, hard shells, & skeletons)
- \* Multi-celled animals
- Ozone layer protected the organisms (UV shield)

400 - 300 million yrs ago:

- Ozone layer allows plants & animals to live out of H<sub>2</sub>O
- Tropical swamps bloom (40-70 ft tall) on all continents
- Bituminous coal is the evidence of these tropical swamps
- Fossil fuels formed - (coal, oil, & gas) (south Georgia)
- Fertile Earth = energy = future Industrial Revolution 1800's
- Enormous insects
- amphibians & reptiles

250 million yrs ago:

- 95% mass extinction of animals bec. of HUGE volcanic eruptions lasting +/- 1 million yrs. (size of USA) <sup>enough to cover USA in lava 1000 ft deep</sup>

240 million yrs ago:

- Pangea is created
- Climate was changing TO<sub>2</sub> ↑ CO<sub>2</sub> new peaks
- Dinosaurs - terrible lizards. (1st dino fossil 1822)

180 million yrs ago:

- Pangea breaks apart because of volcanic activity

100 million yrs ago:

- Increased tropical plant life ∴ dinosaurs increased in size (specialization) (land, air, & sea)
- 1869 Kimberly mine of Africa finds diamonds



100 miles deep in an old volcano

65 million yrs ago:

- Bye bye dinosaurs (Combo death (2 reasons))
- sudden catastrophe
- Alvarez theory: Mexico Crater-1990 - thin line layer
- in sedimentary rock there was a clay layer.
- TOMBSTONE LAYER → iridium (from space rock)
- Meteor vaporized Earth's crust into dust & debris
- massive volcanic eruptions (dust) western India

size of Mt Everest

50 million yrs ago:

- ~ The Age of Mammals
- ~ Plate tectonics (uplift) & erosion
- ~ Earth is building our landscape as we know it.
- African vs. European matterhorn Plate

6 million yrs ago:

- Grand Canyon begins to form
- 1 mile deep, 11 miles wide, 277 miles long
- Colorado River = erosion
- Pacific vs N. American Plate = uplift (Plate tectonics)

2 million yrs ago:

- Ancestors of modern humans are first seen
- The Ice Age arrives
- grooves in rocks in NYC Central Park gives us evidence of glaciers (ice was 2X as thick as height of Empire State building.)

10 Thousand yrs ago:

- Last glaciers left behind features: Cape Cod & Long Island
- Huge weight of the glaciers created a depression: The Great Lakes
- age of early humans

Present Day:

- Short period of time (a fraction of a fraction of 1%)
- Humans dominate the Earth
- Earth impacts what lives or doesn't live (climate Global warming)

present Day continued:

Geology: Life Thrives :: Stable Earth: Life Exists (analogy comparison)

+ 15 Thousand yrs: Hypothesis  
New Ice Age → Predict NYC swallowed by glacier/  
whole countries would disappear

+ 200 million yrs: Hypothesis  
- Pangea Ultima will be formed  
- surface temp ↑ = mass extinction event  
- Humans & Earth use up the fuel → Dead Planet  
like Mars

+ 1 Billion yrs: Hypothesis  
- Life would continue (humans? ENDANGERED)  
\* Technology MAY allow humans to find another  
habitable blue/green planet

Mrs. Wilder 11-19-13

(6)

# Evolution of Life on Earth in 24 hrs

