


Disclaimer


This series represents the personal views of scientists who attend Grace Chapel.

Our understanding of science continually changes with new data and so will our views.

Therefore, the views we will be presenting should not be taken as absolute truth.

Alternative views on science and faith are not only possible but expected as well as encouraged.

Grand Canyon: flat-lying rock layers

By 1850s Christians in geology agreed:

- Long time needed to form the various geologic layers
- Earth must be extremely old; death in animals before Fall
- Geology did not support a global flood.
- Theologians need input from science for interpretation of Scripture.

150 Years of Professional Geology

Sedimentary:

- Thousands of feet thicknesses of sedimentary rocks
- Various depositional environments, fossil evidence

Igneous:

- Magma bodies: chemical evolution & fractional crystallization
- Intrusion & impact on host rocks.
- Large surface basalt flows, dikes & sills

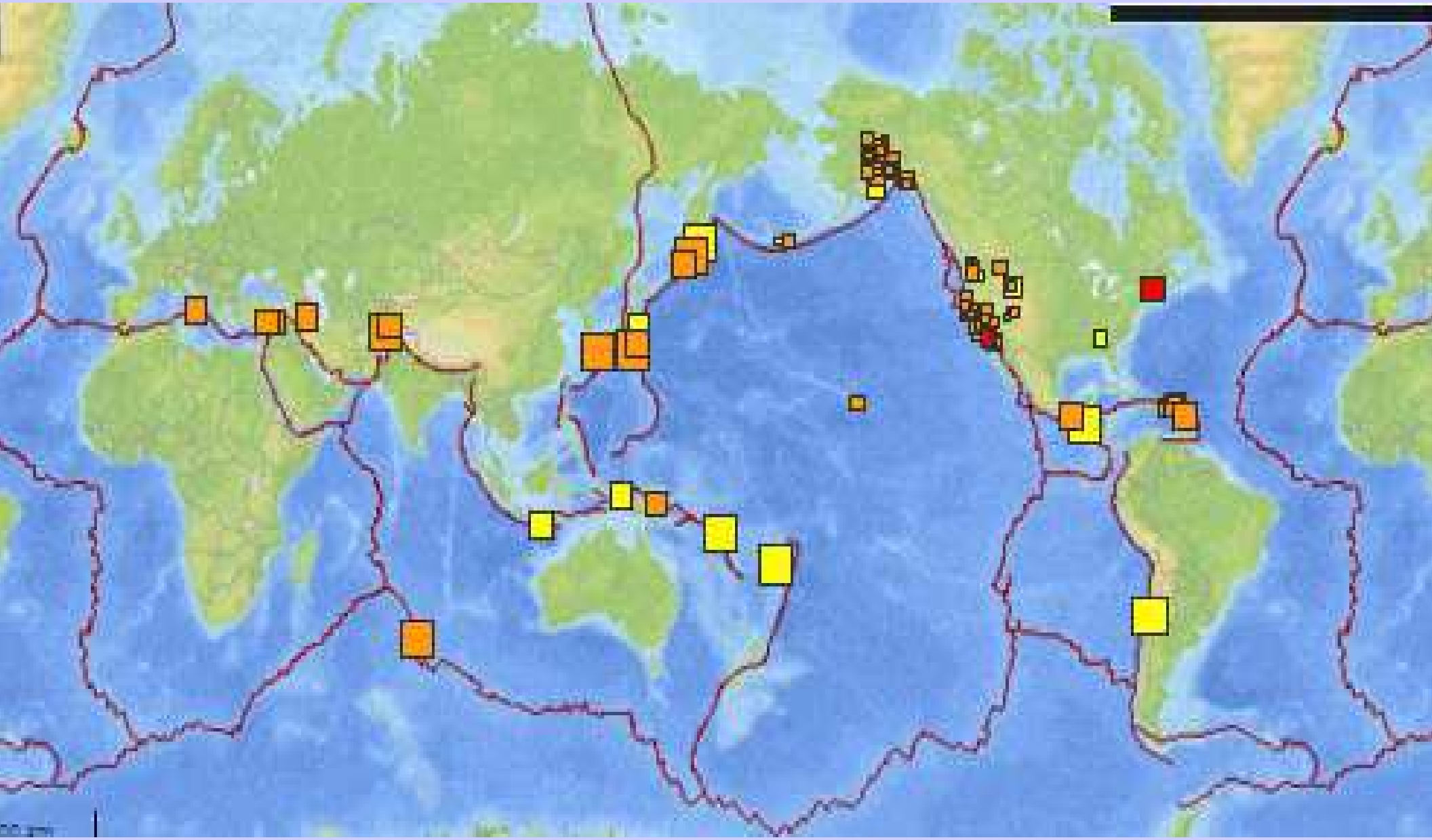
Metamorphic:

- Depth of burial increases temperature
- High & low pressure environments
- Mineral chemical reactions record geologic history (countertops?)

Geologic Evidence for Old Age of Earth

- Plate tectonics. A good framework that explains many broad lines of evidence.
- Radioactive dating. Oldest zircon ages 4.4 b.y. (initial crystallization from magma)
- Vast thicknesses of sedimentary rocks, with features that suggest erosional episodes, land deposition, and dry periods.

Earthquakes around the World

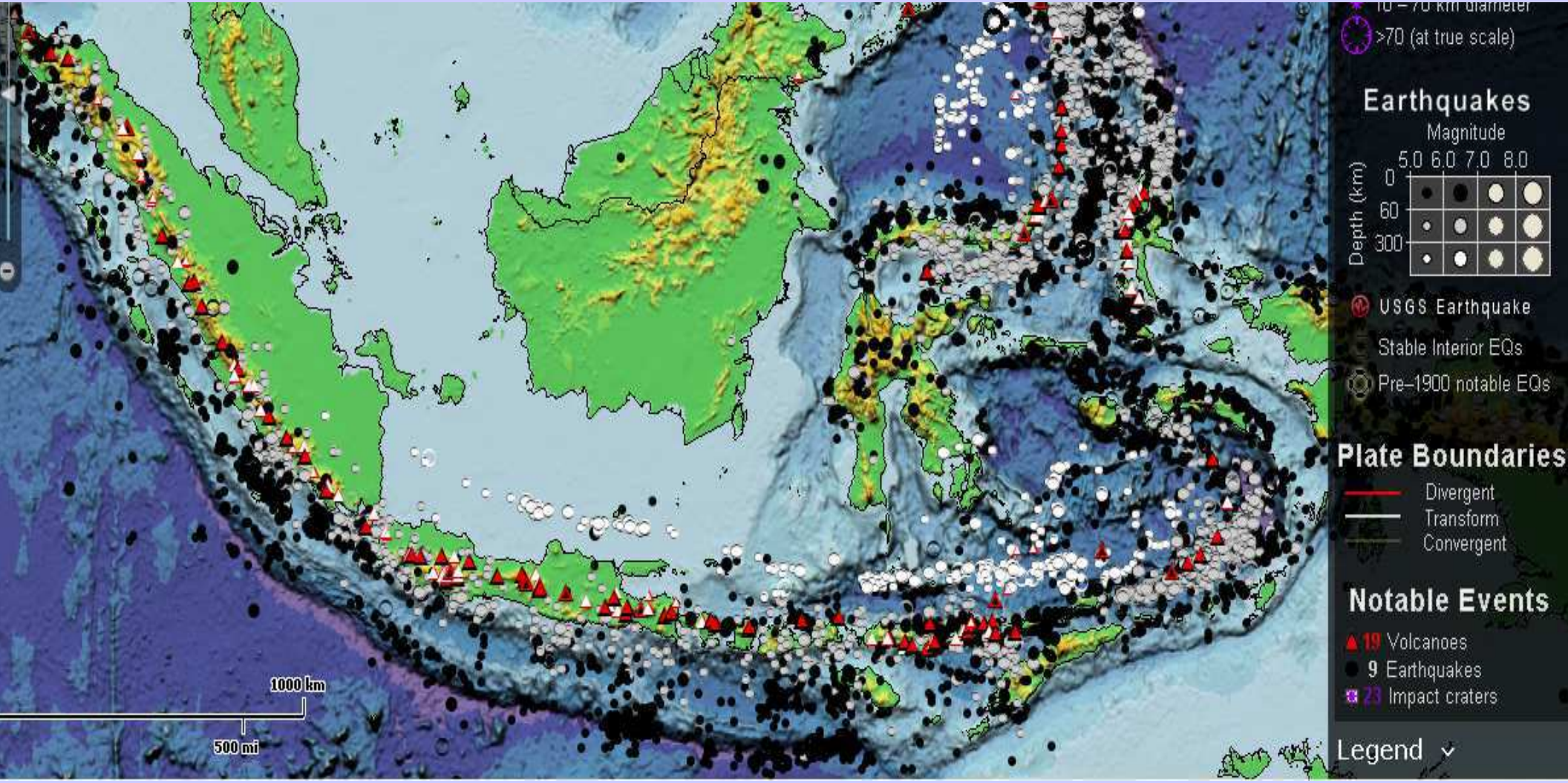


http://earthquake.usgs.gov/earthquakes/map/

Active Volcanoes, Plate Tectonics, and the "Ring of Fire"

Topinka, USGS/CVO, 1997, Modified from: Tilling, Heliker, and Wright, 1987, and Hamilton, 1976

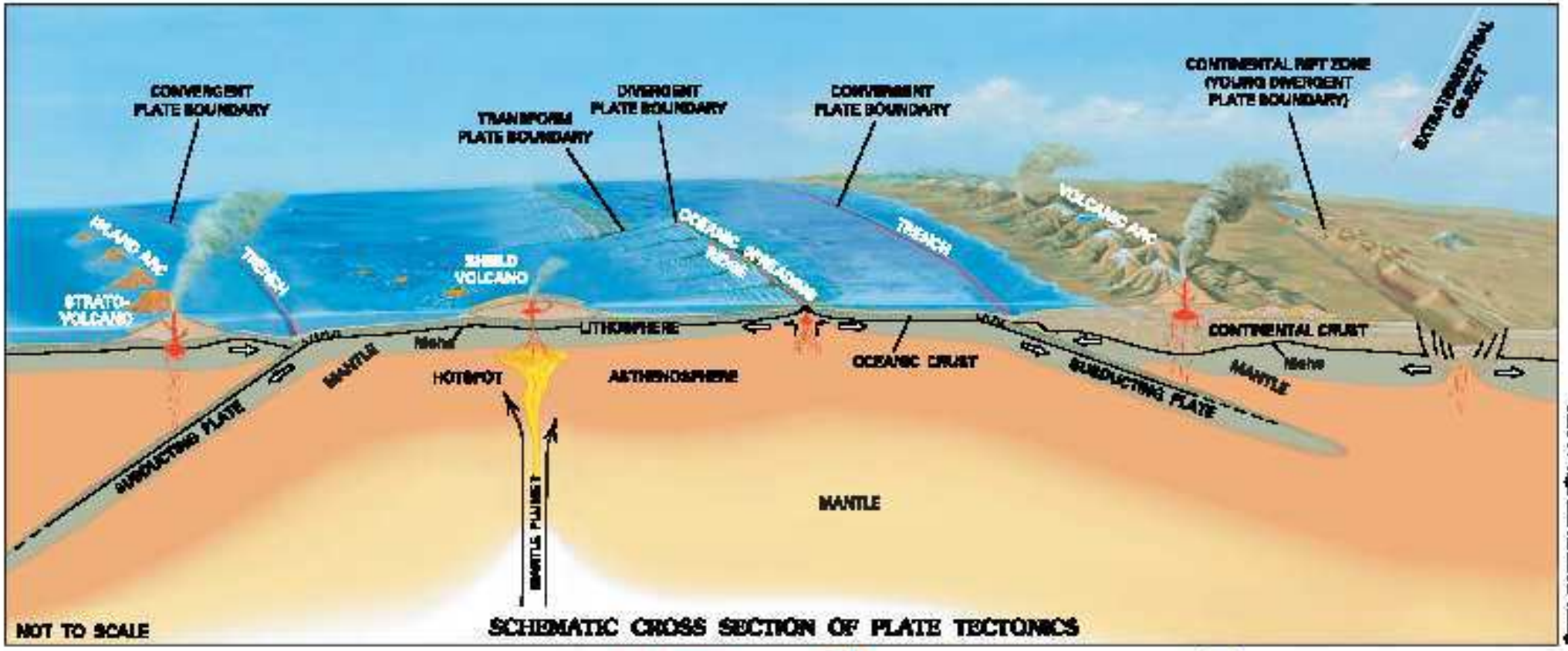
This Dynamic Planet



Earthquakes & volcanoes in Malaysia & Indonesia

http://nhb-arcims.si.edu/ThisDynamicPlanet/index.html

Schematic Cross Section of Plate Tectonics



USGS Smithsonian Institution U.S. Naval Research Laboratory

http://volcano.si.edu/tdpmap/

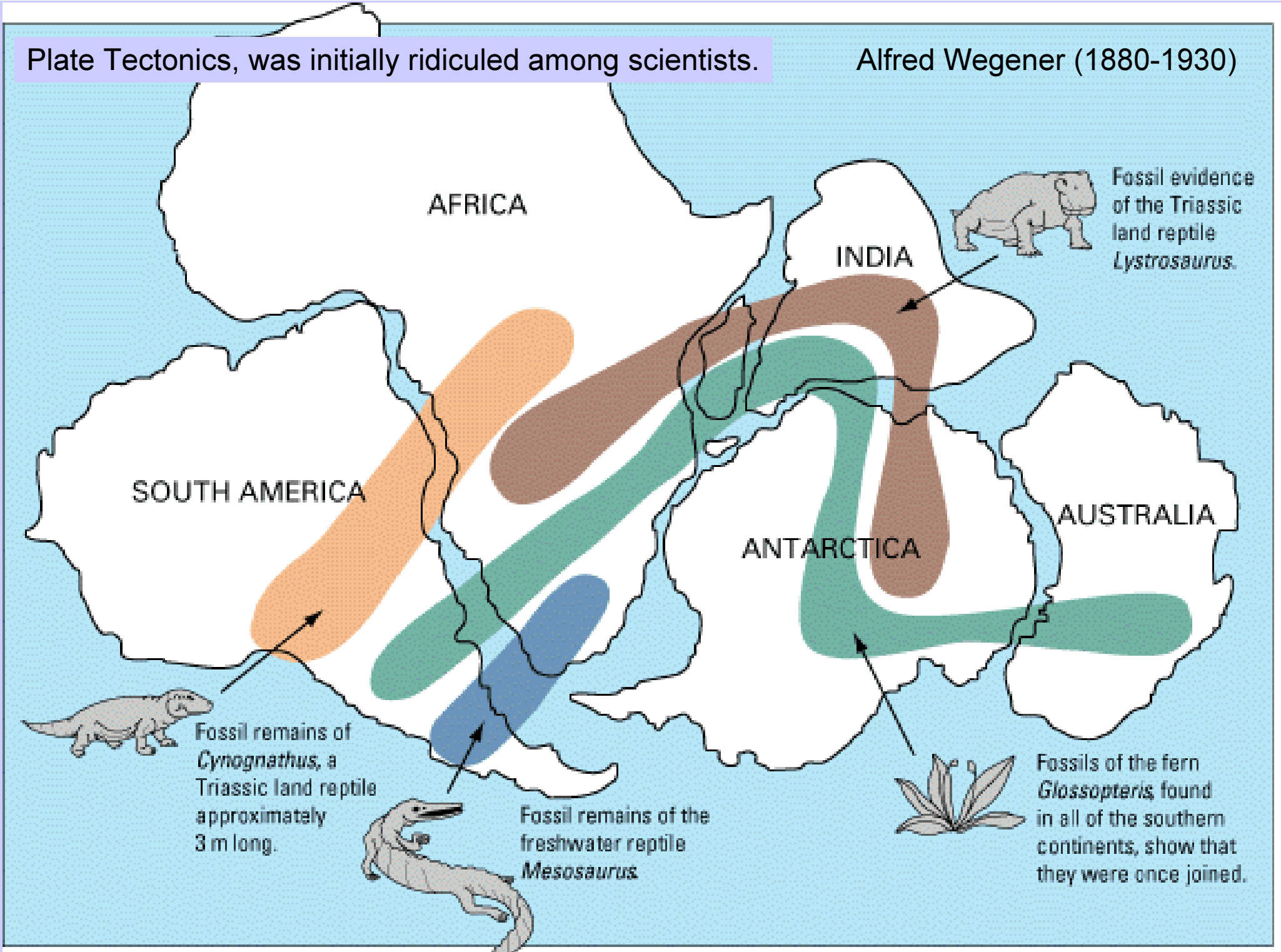
Superc ontinen t

250 million years ago

http://en.wikipedia.org/wiki/File:Pangaea_continents.svg

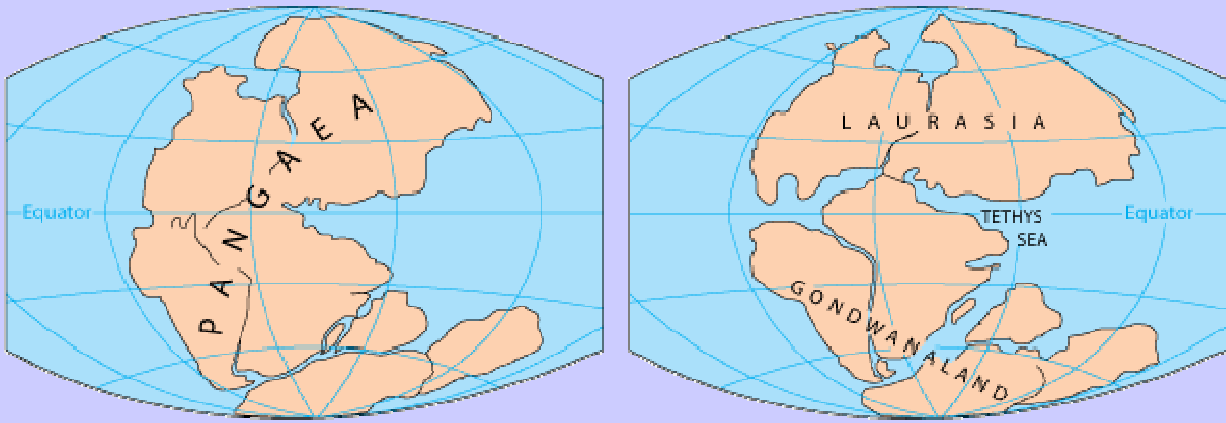
Plate Tectonics, was initially ridiculed among scientists.

Alfred Wegener (1880-1930)



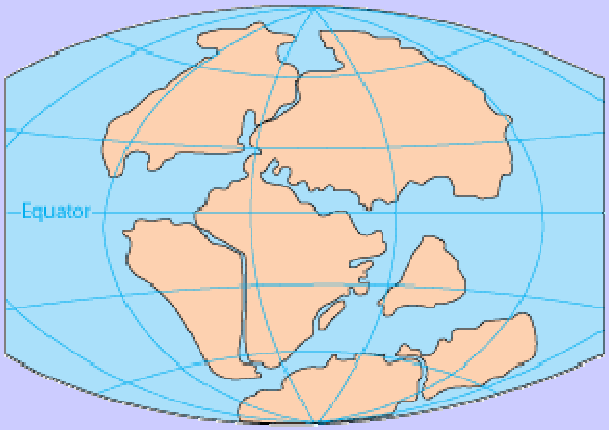
Map courtesy This Dynamic Earth, United States Geological Survey

rectonic Plate Reconstruction

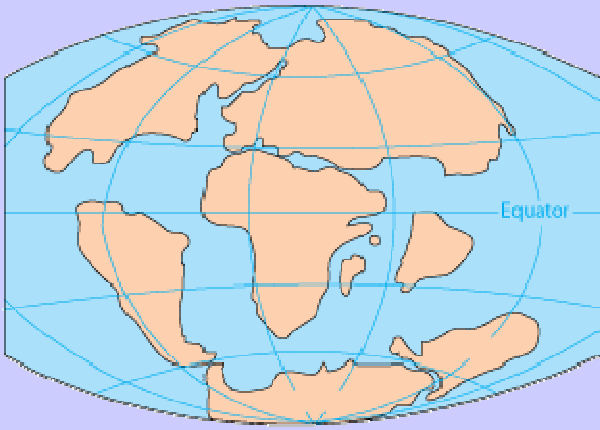


PERMIAN
250 million years ago

TRIASSIC
200 million years ago



JURASSIC
145 million years ago



CRETACEOUS
65 million years ago

PRESENT DAY

http://pubs.usgs.gov/gip/dynamic/historical.html

Geologic Dating Methods

- **Geologic Time Scale**
  - Very detailed time periods based on geologic data from around the world.
  - The entire geologic column is found in North Dakota and 25 other locations around the world
- **Radioactive Dating**
- **Varves & Tree Rings**

http://pubs.usgs.gov/fs/2010/3059/pdf/FS10-3059.pdf

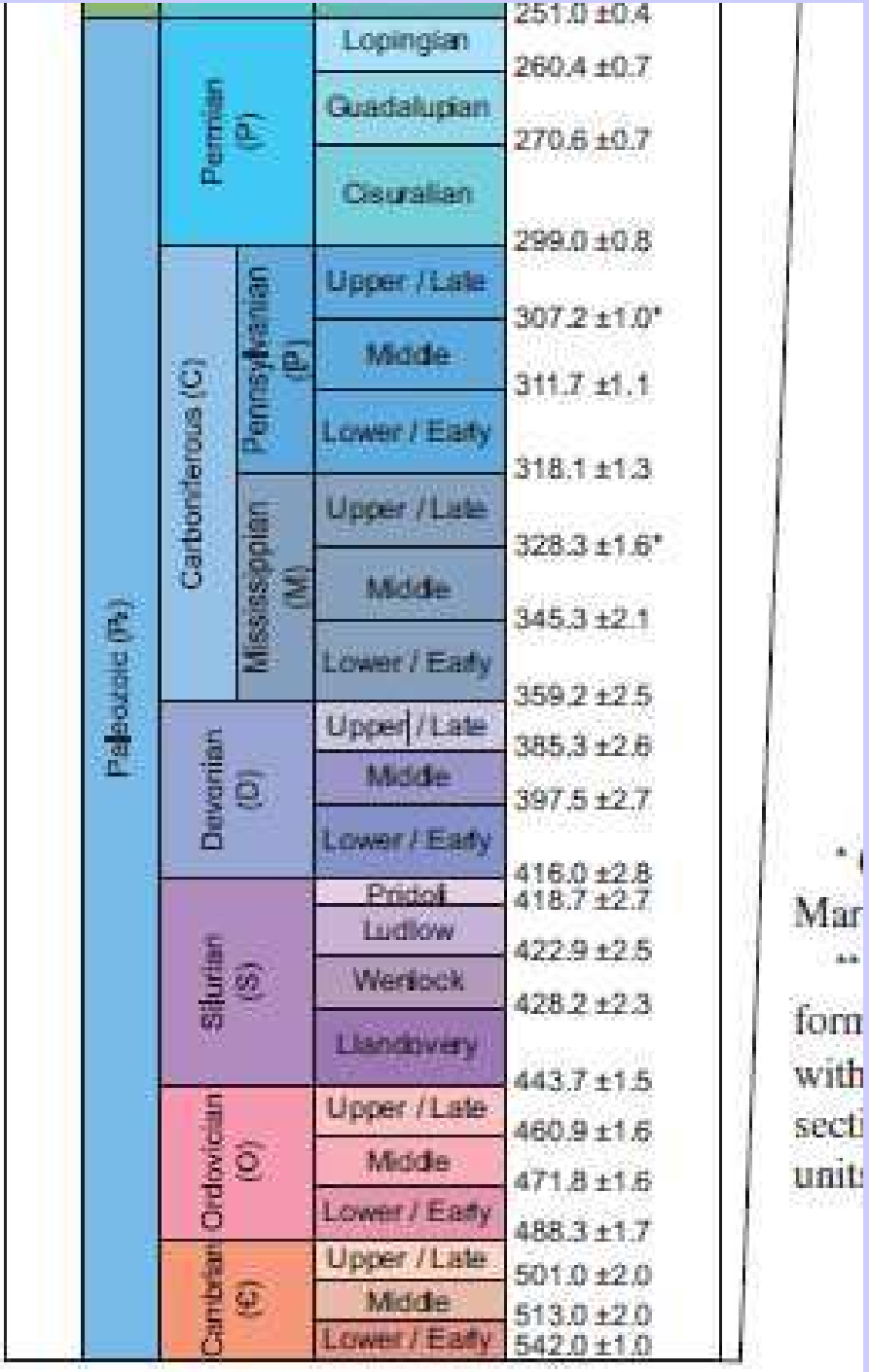
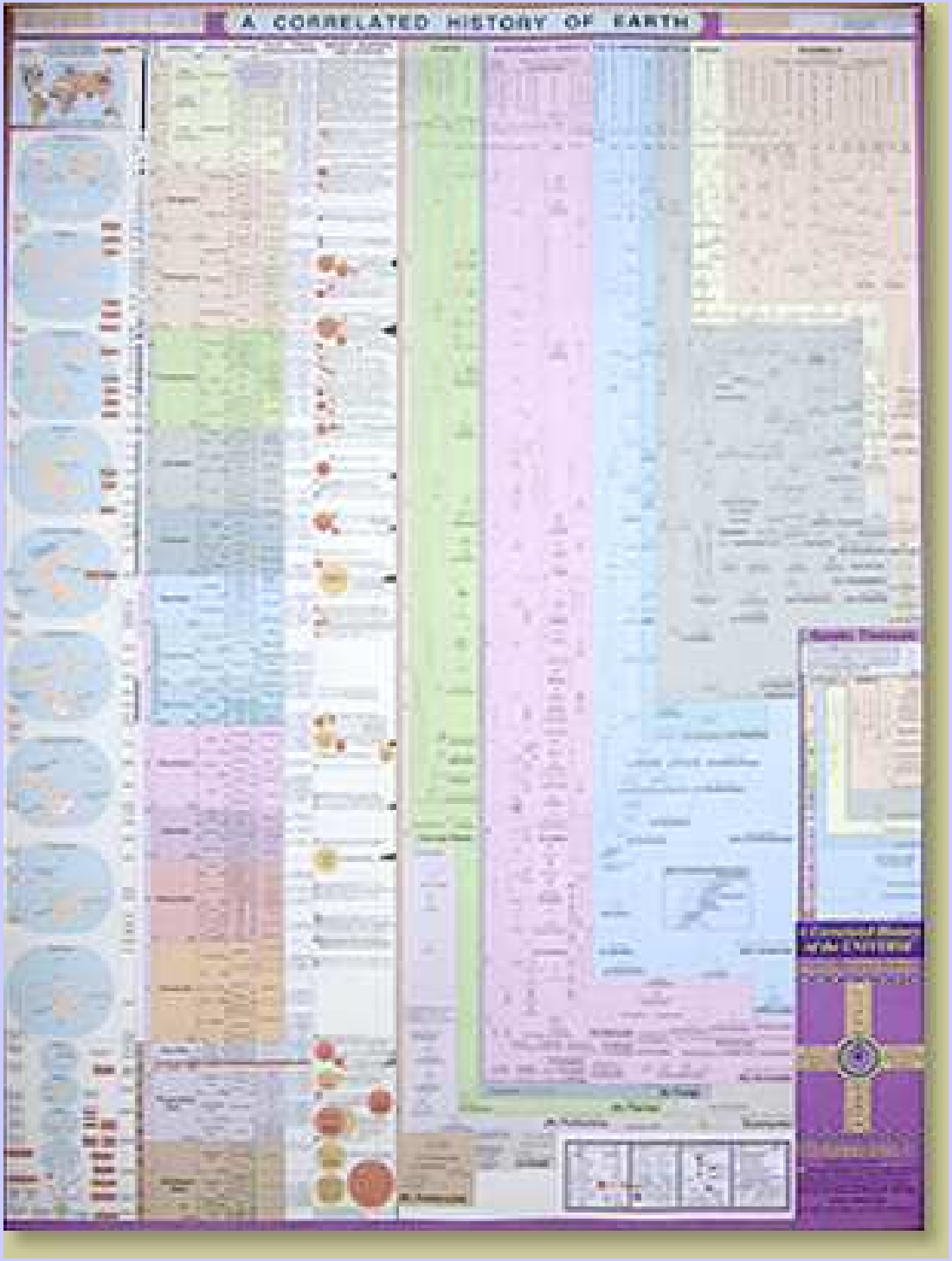


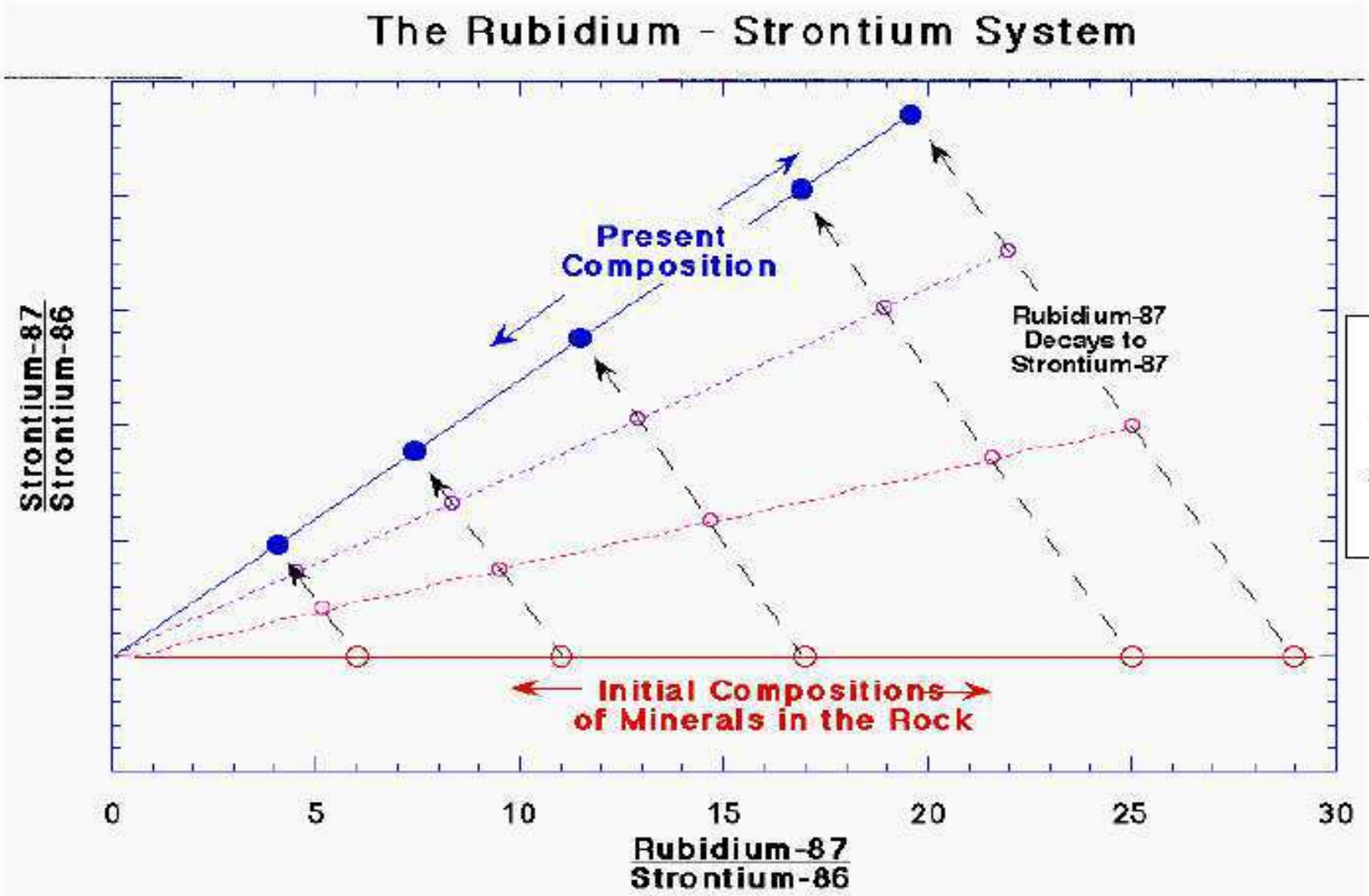
Figure 1. Divisions of Geologic Time appro

- # A Correlated History of Earth

(PanTerra Inc.) documents 4.5 billion years of Earth.

- plate tectonic maps, mountain building events (orogenies), major volcanic episodes, glacial epochs, all known craters from asteroid and comet impacts, over 100 classic fossil localities from around the world, fossil ranges of plants, invertebrates and vertebrate lifeforms, and major extinction events as revealed by the fossil record. Also evident on this chart are the Cambrian "explosion" of animal phyla and the juxtaposition of reptiles and mammals across the Cretaceous/Tertiary(K/T) boundary

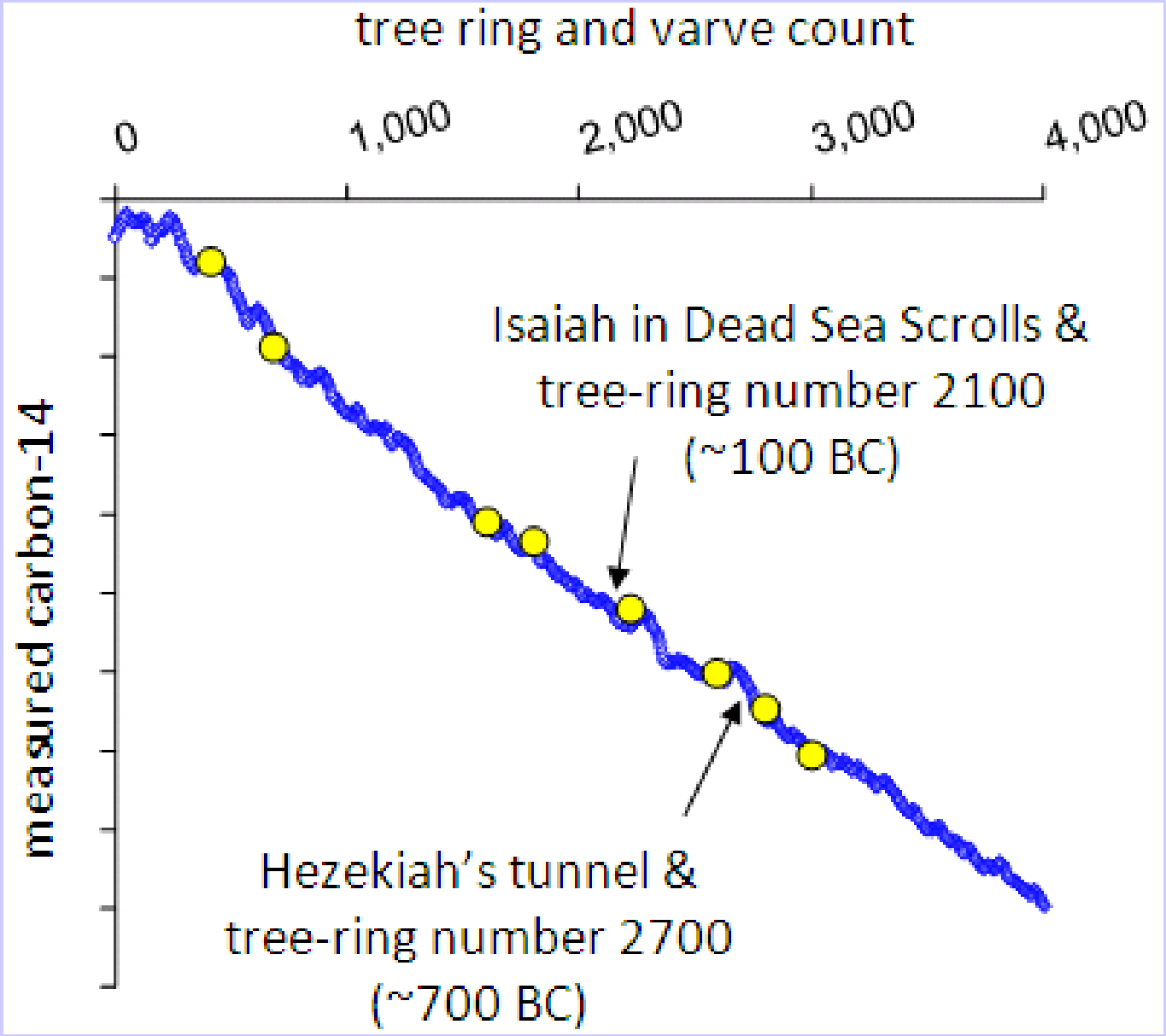




Same ratio at cooling: Strontium-87 / Strontium-86

Figure 4. A rubidium-strontium three-isotope plot. When a rock cools, all its minerals have the same ratio of strontium-87 to strontium-86, though they have varying amounts of rubidium. As the rock ages, the rubidium decreases by changing to strontium-87, as shown by the dotted arrows. Minerals with more rubidium gain more strontium-87, while those with less rubidium do not change as much. Notice that at any given time, the minerals all line up—a check to ensure that the system has not been disturbed.

Radiometric Dating: A Christian Perspective By Dr. Roger C. Wiens.
http://www.asa3.org/ASA/resources/Wiens2002.pdf



Dating Methods

Measured carbon-14 and tree rings (solid line) and varves (open circles) back to 4,000 rings/varves.

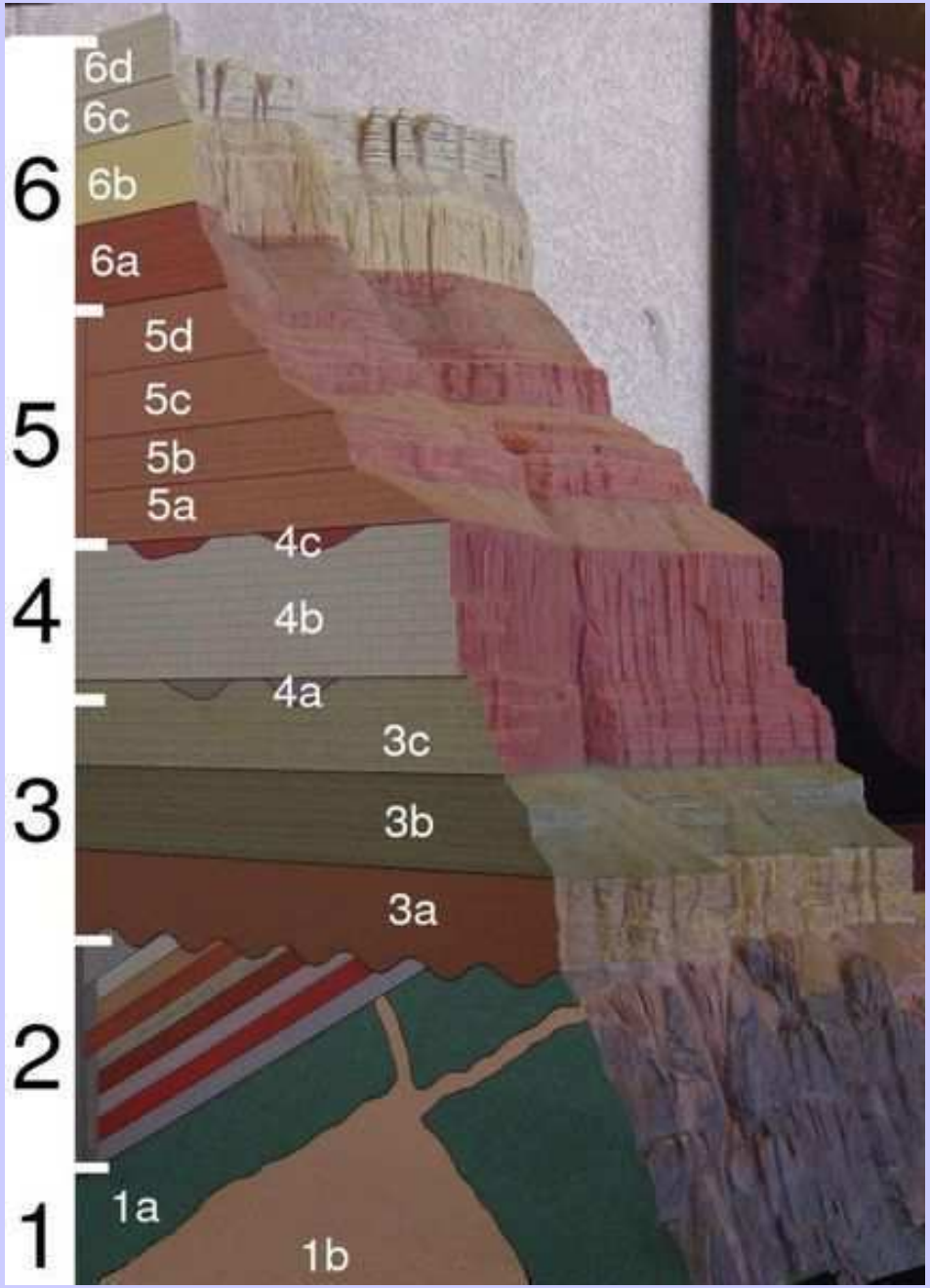
Varve data from Lake Steel, Minnesota.

Carbon-14 axis is the natural logarithm of the measured activity – each tick mark is 0.1 unit.

Lake Suigetsu, Japan deposits contain nearly 100,000 varves representing almost 100,000 years.

Can a global flood explain global observations in sedimentary rocks?

- Vast thicknesses of salt layers (evaporation) underlying sedimentary rocks
- the geologic column also contains: rain drops, river channels, wind-blown dunes, beaches, glacial deposits, burrows, soil, mud cracks, footprints, meteor craters, coral reefs, caves, varves
- The geologic column is not sorted in hydro-dynamic order. Coarse-grained and fine-grained layers alternate throughout.
- Fossil record – not all mixed together, rather an orderly, predictable sequence.



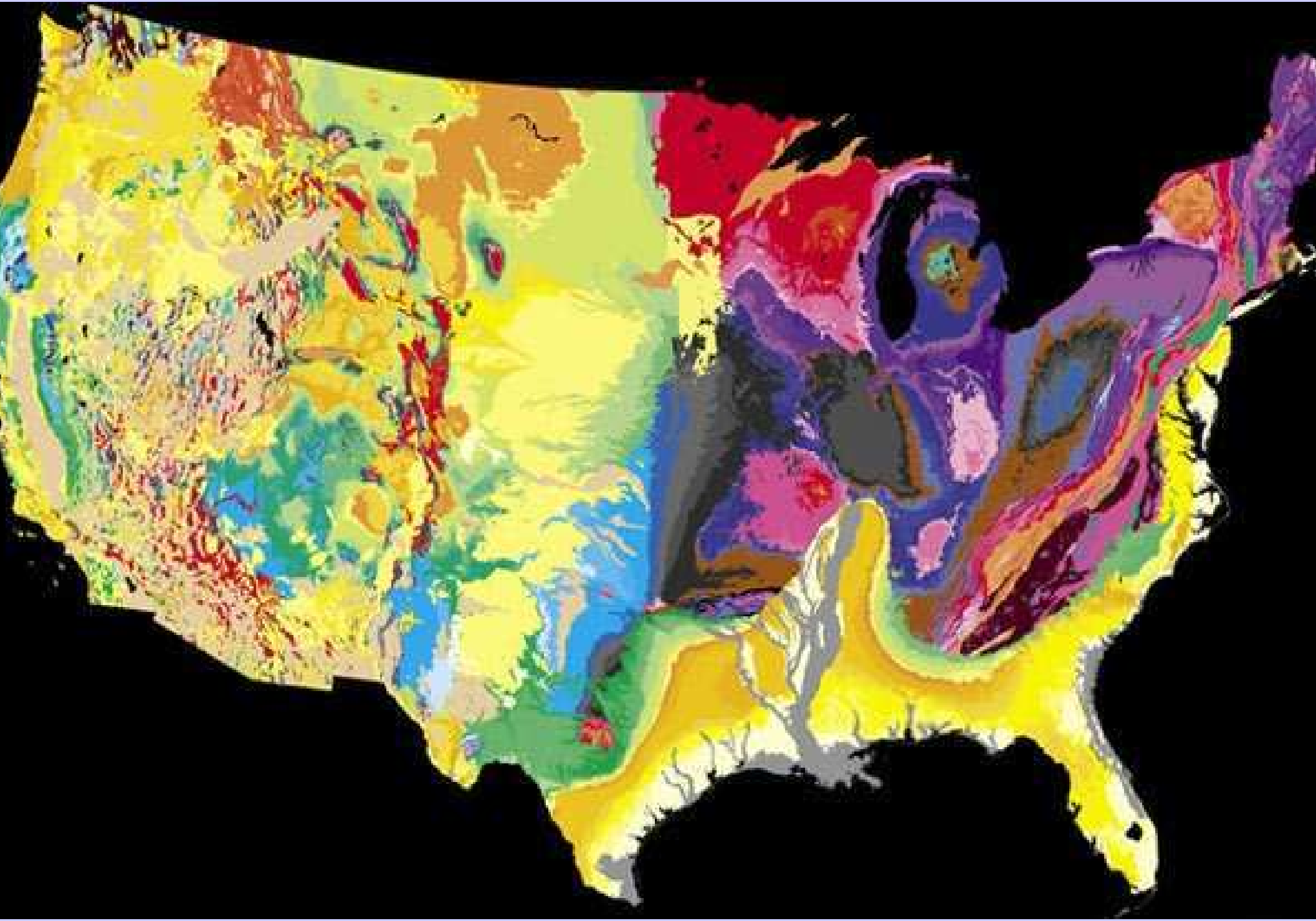
Coarse-grained (faster water) and fine-grained (slower water)

inter-layered

Flood Geology Errors

1. Confuse **uniformitarian Geology** (how earth's surface developed) with **evolutionary Biology** (how life developed)
2. Number of animals/plants represented in fossil record is far greater than today – we are zoologically impoverished today?
3. Flood 'geologists' do not understand physical & chemical conditions of how rocks form & fold.
4. Later geologic discoveries show that flood geology was not possible.

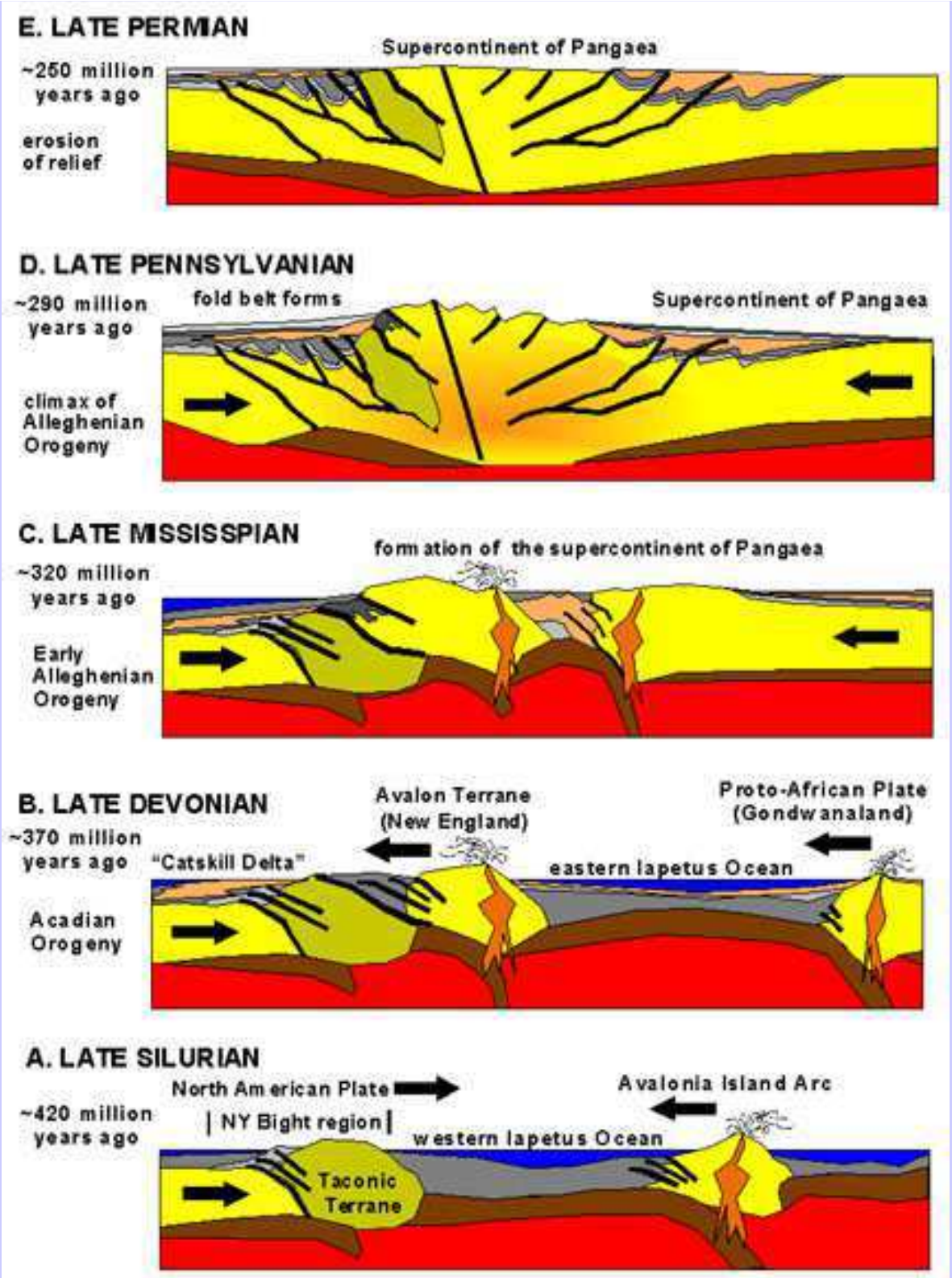
George McCready Price 1923, *The New Geology*



Massachusetts Geology

Multiple metamorphism events

Dinosaur footprints



Geologic History of New England

http://en.wikipedia.org/wiki/File:Appalachian_orogeny.jpg

Relative Dating: Relative order of geologic events

- **Originally Horizontal**

  (deposited as horizontal or nearly horizontal layers)

- **Superposition**

  (bottom of the sequence is oldest)

- **Cross-cutting Relationships**

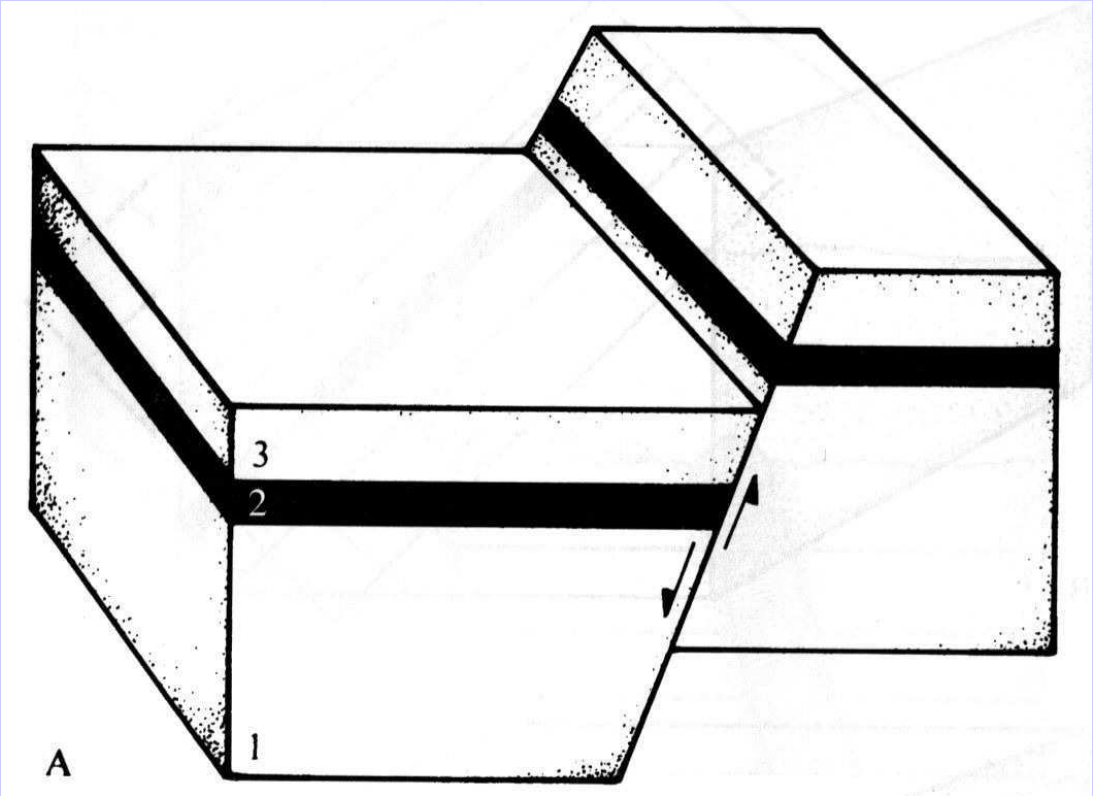
  (geologic features must be younger)

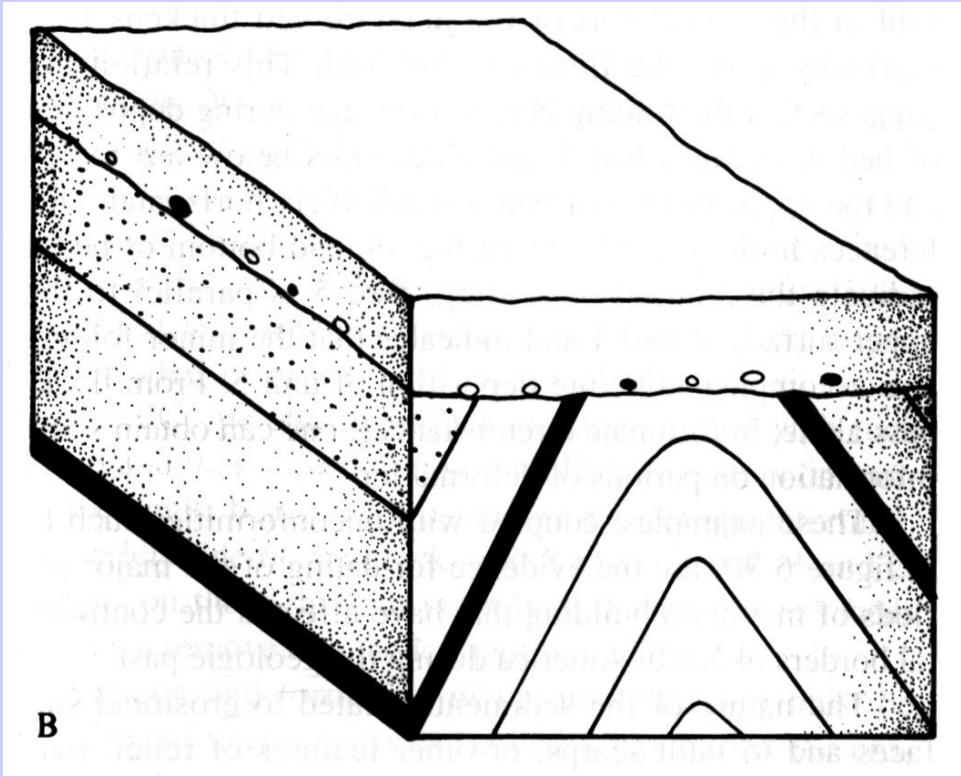
- **Inclusion**

  (fragments must be older than the layer in which they are included)

http://cns.uni.edu/~groves/LabExercise02.pdf

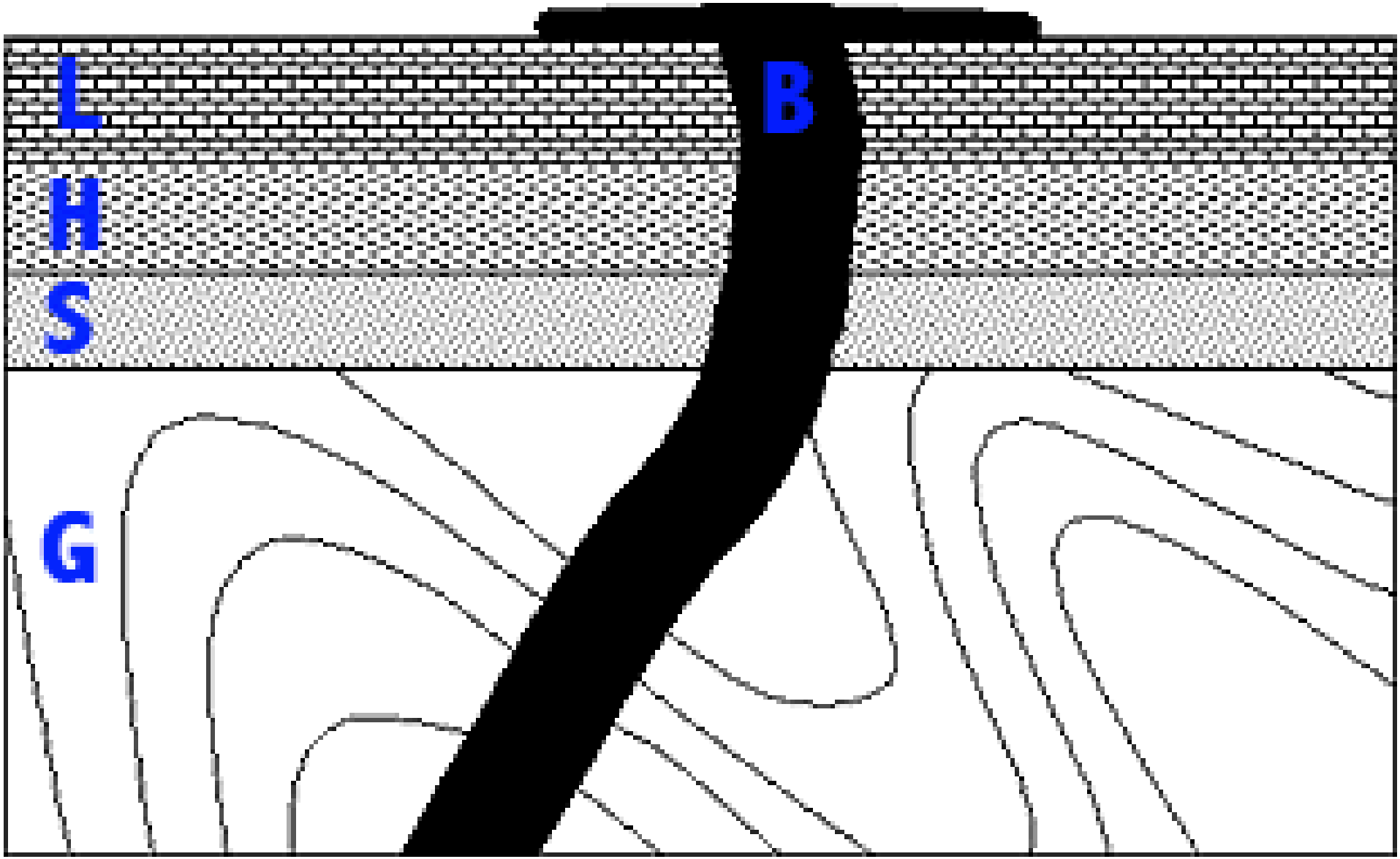
Relative Dating



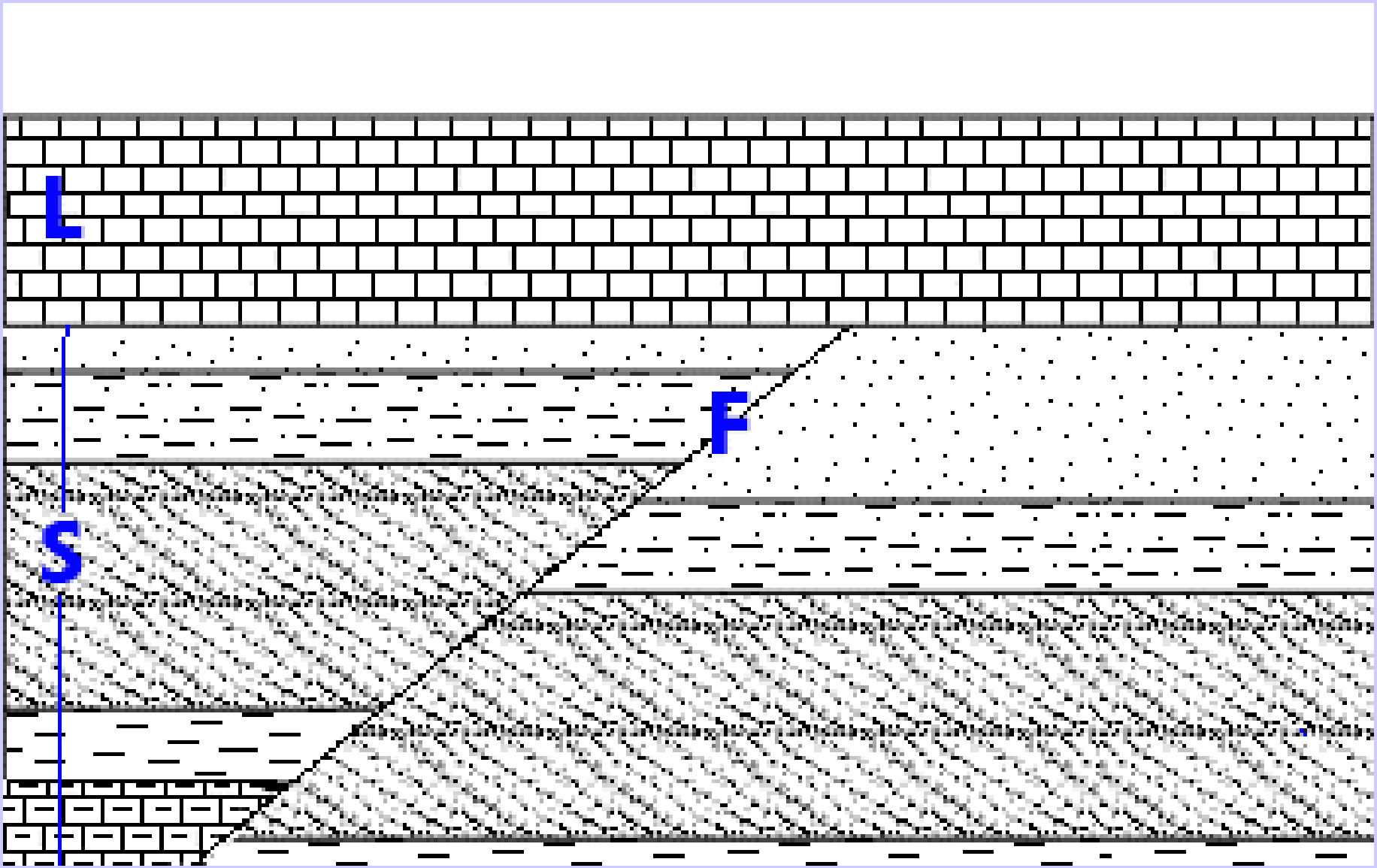


- *Figure 1*—(A) Sedimentary beds 1–3 were deposited as horizontal layers. Sometime later, a normal fault occurred. (B) Sedimentary beds 1–7 were deposited as horizontal layers. Later, these beds were folded into an anticline. Later still, the anticline was truncated by an erosional unconformity, and finally, an eighth sedimentary bed was deposited as a horizontal layer. Inclusions of older rock fragments (derived from beds 1–7) are found at the base of bed 8.

Relative Geologic History (1)



Relative Geologic History (2)



Resources

Affiliation of Christian Geologists http://www2.wheaton.edu/ACG/

American Scientific Affiliation http://www.asa3.org/ASA/

- Theologians Need to Hear from Christian Geologists About Noah's Flood
  By Ken Wolgemuth, Gregory S Bennett, and Gregg Davidson
- Radiometric Dating: A Christian Perspective
  By Dr. Roger C. Wiens
- Neglect of Geologic Data: Sedimentary Strata Compared With Young-Earth Creationist Writings
  By Daniel E. Wonderly

- Geology
- http://nhb-arcims.si.edu/ThisDynamicPlanet/index.html
- http://www.usgs.gov/
- http://www.geosociety.org/

Neglect of Geologic Data: Sedimentary Strata Compared with Young-Earth Creationist Writings By Dan Wonderly

Chapter 2: Significance of the great thicknesses of sedimentary rocks in the Appalachian region and other areas.

Appalachian limestones are often found alternating with strata of quartz sandstones, siltstones, and shales.

Approximate thicknesses of limestone in eastern & central WV, western MD, west-central PA, western VA

- Cambrian: 7,000ft thick over most of this area, up to 11,000 ft in some counties.
- Ordovician: 2,500 ft thick over most of this area, up to 6,000 ft of Ordovician limestones.
- Silurian, Devonian, Mississippian: average 1,000 ft of limestones over most of this area

In most areas of the Appalachians, the thickness of non-carbonate (clastic) sedimentary rocks is greater than that of the limestone, up to 20,000 to 35,000 ft in eastern WV & western VA.

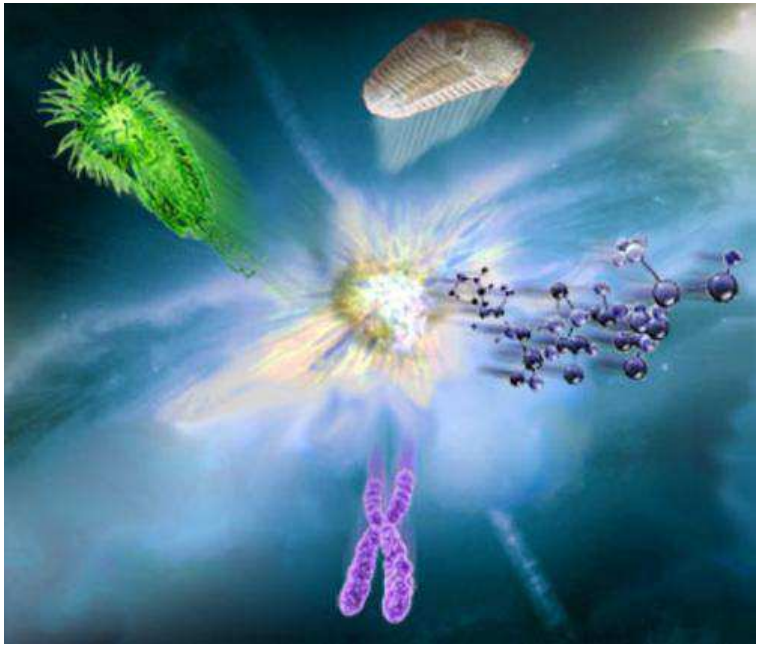
Rates of rapid deposition today:

- Carbonate deposition in a semitropical shelf environment: 1ft (30 cm) per 1,000 years
- Coral reef deposition: 24ft (8m) per 1,000 years
- Noncarbonated deposition on continental shelves usually averages .5 to 1.5 ft(15-40 cm) per 1,000 years.
- Deep ocean floor deposition of carbonate & noncarbonated much slower (not applicable to Appalachians)

Special features of limestone deposition:

- Most limestone deposits are from biological origin (due to growth of lime-secreting plants & animals).
- Chemical precipitation is a slow, rare process & occurs only when CaCO3 is super-saturated in warm, tranquil ocean water.
- Some limestones contain *in situ* biological growth structures such as stromatolites and algal mats, small bioherms, large organic banks, and coral-algal reefs. All of these growth structures can be found in Europe & N America in thousands of locations. This tends to mean that the limestone was preserved in its original undisturbed state.

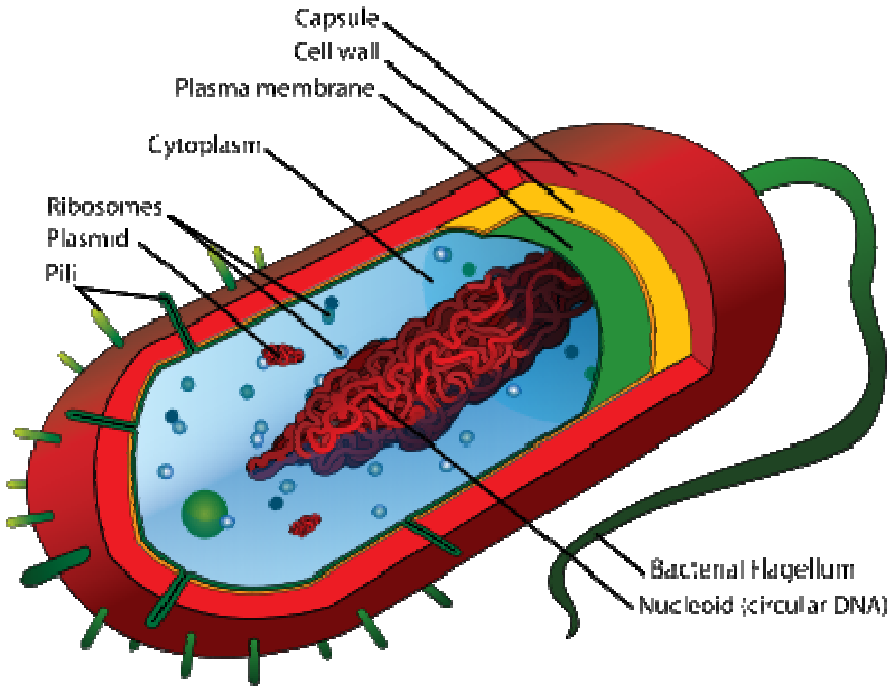
How did Life Begin?



Abiogenesis: The creation of life from non-life

Karma Carrier, Ph.D.

What is Life?



Replication is a Basic requirement for life

The cell is the basic unit of life

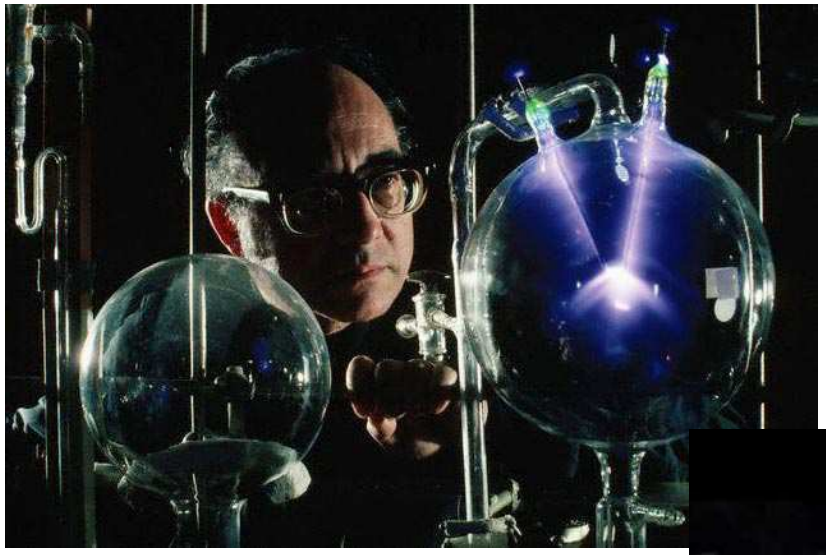
What was early life like?

Stromatolites: a primitive form of life

Life originated about 3.8 billion years ago

The first life replicated without complex proteins

Studying Life's Origin



Stanley Miller

Organic molecules were common on the early Earth

Life came to exist in prebiotic conditions

Primordial Soup

Where Does God Fit in?

God could have used several mechanisms to create life

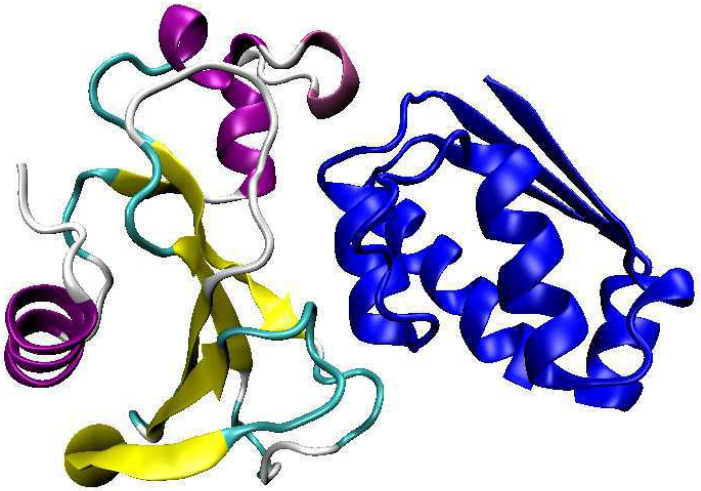
Direct Intervention?

God directly created the first life on Earth

Random Chance?

Random Chance

"Luck"

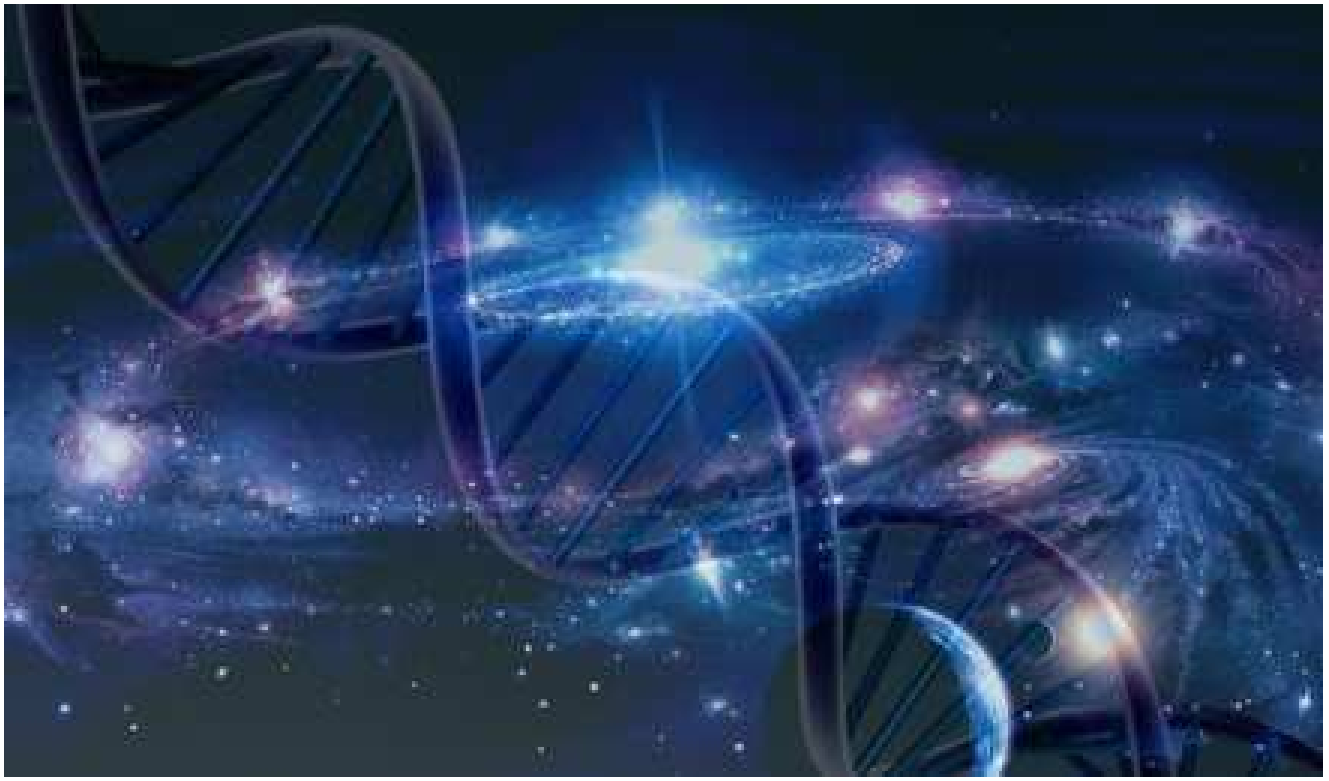


Complex Proteins
and Life

Alien Origins?

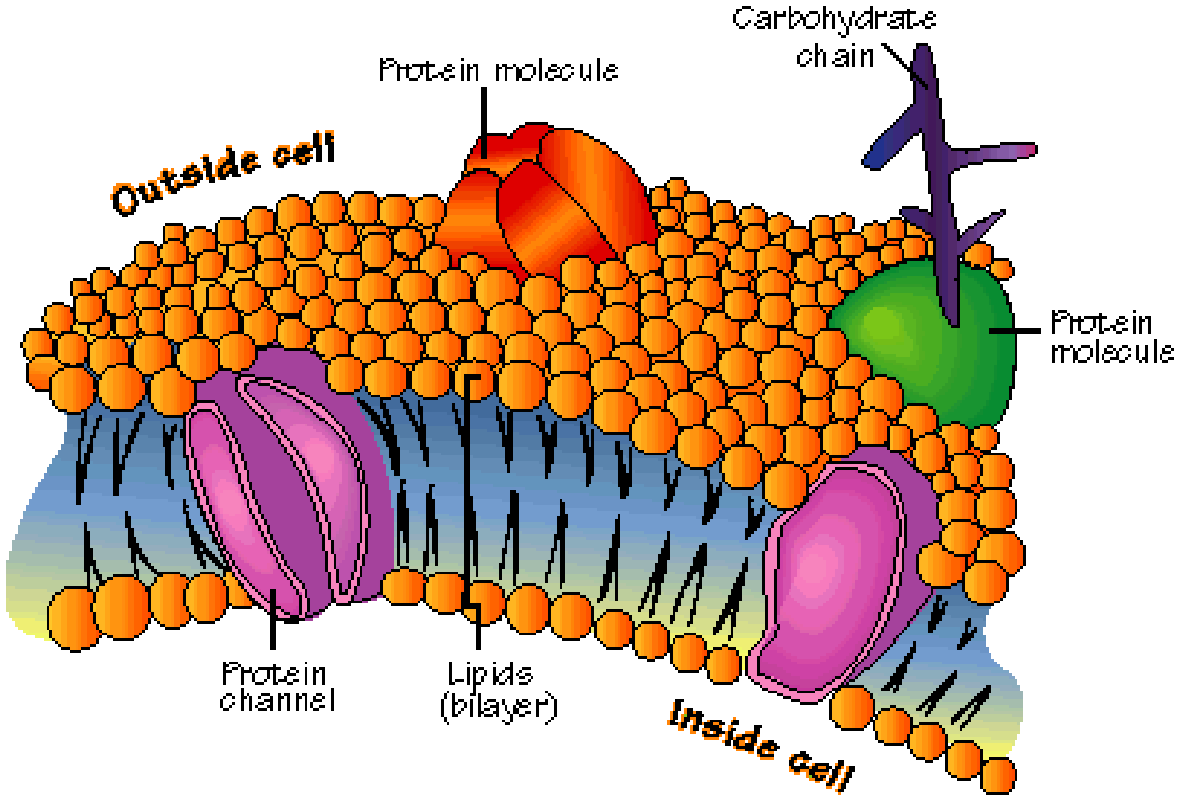
Panspermia: spreading of life through space

Fine Tuning?



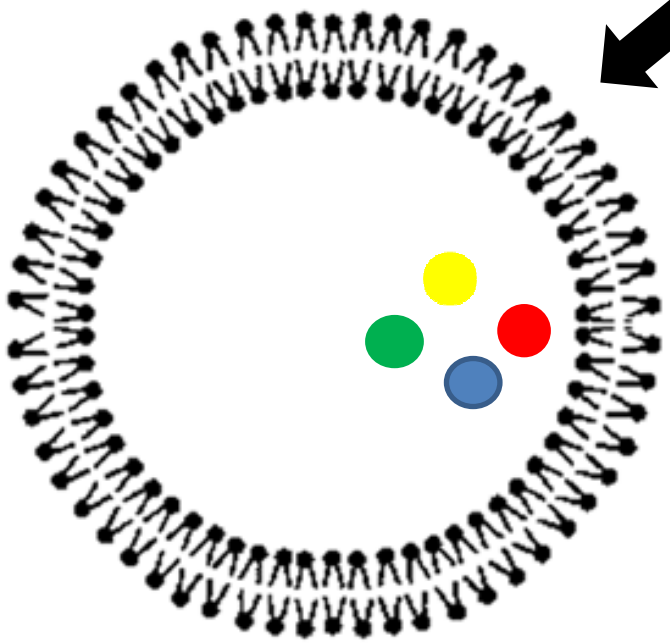
The Earth is a life generating factory

Modern Cell Membranes Required Proteins

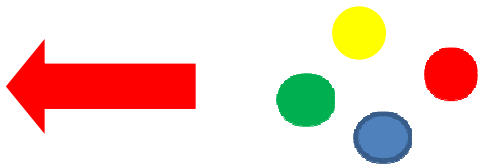


Early life could not use modern phospholipids so how did they separate themselves from the environment?

Vesicles made with Simple Lipids



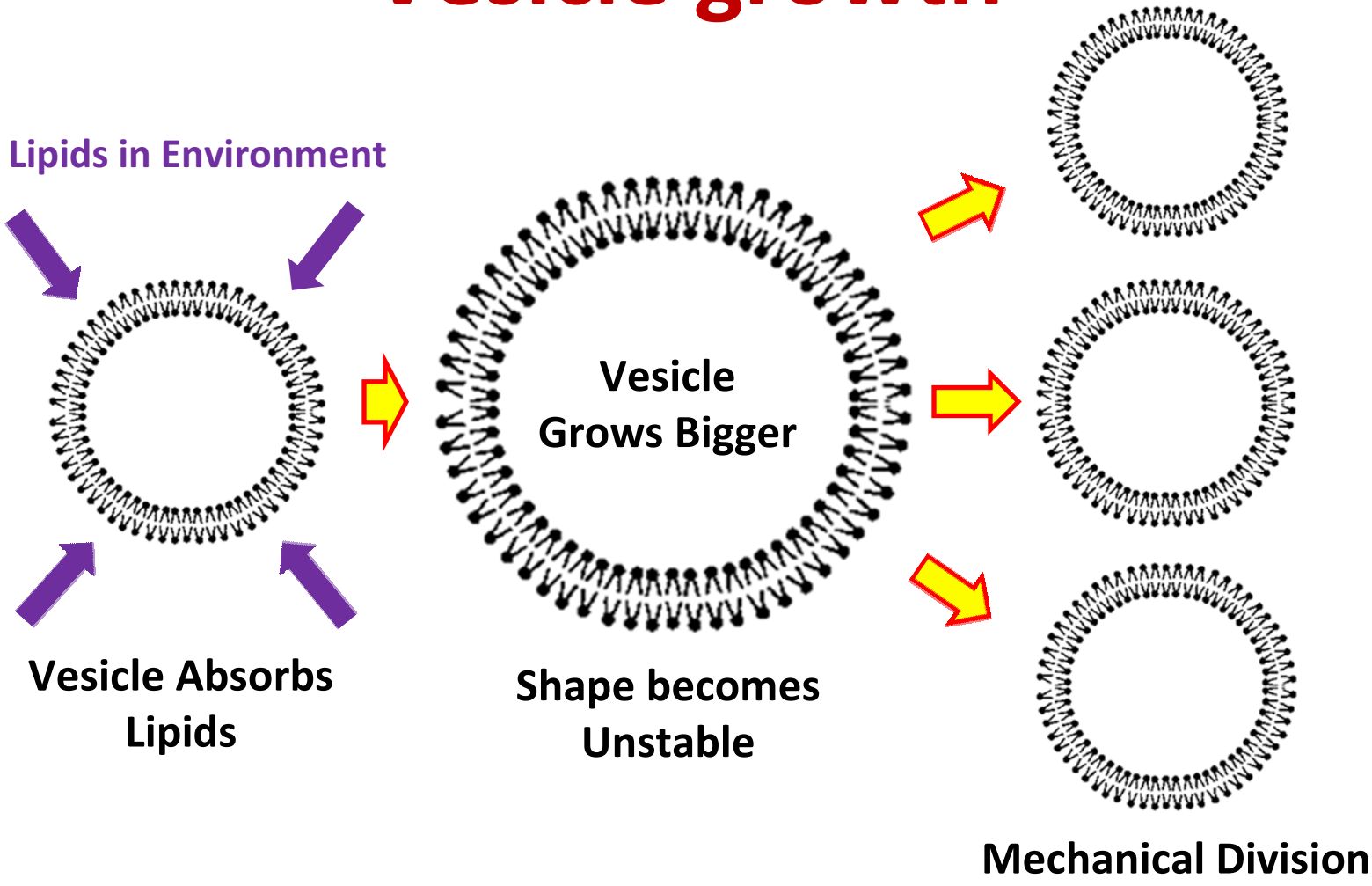
Simple lipids
Spontaneously form Vesicles
with a lipid bilayer



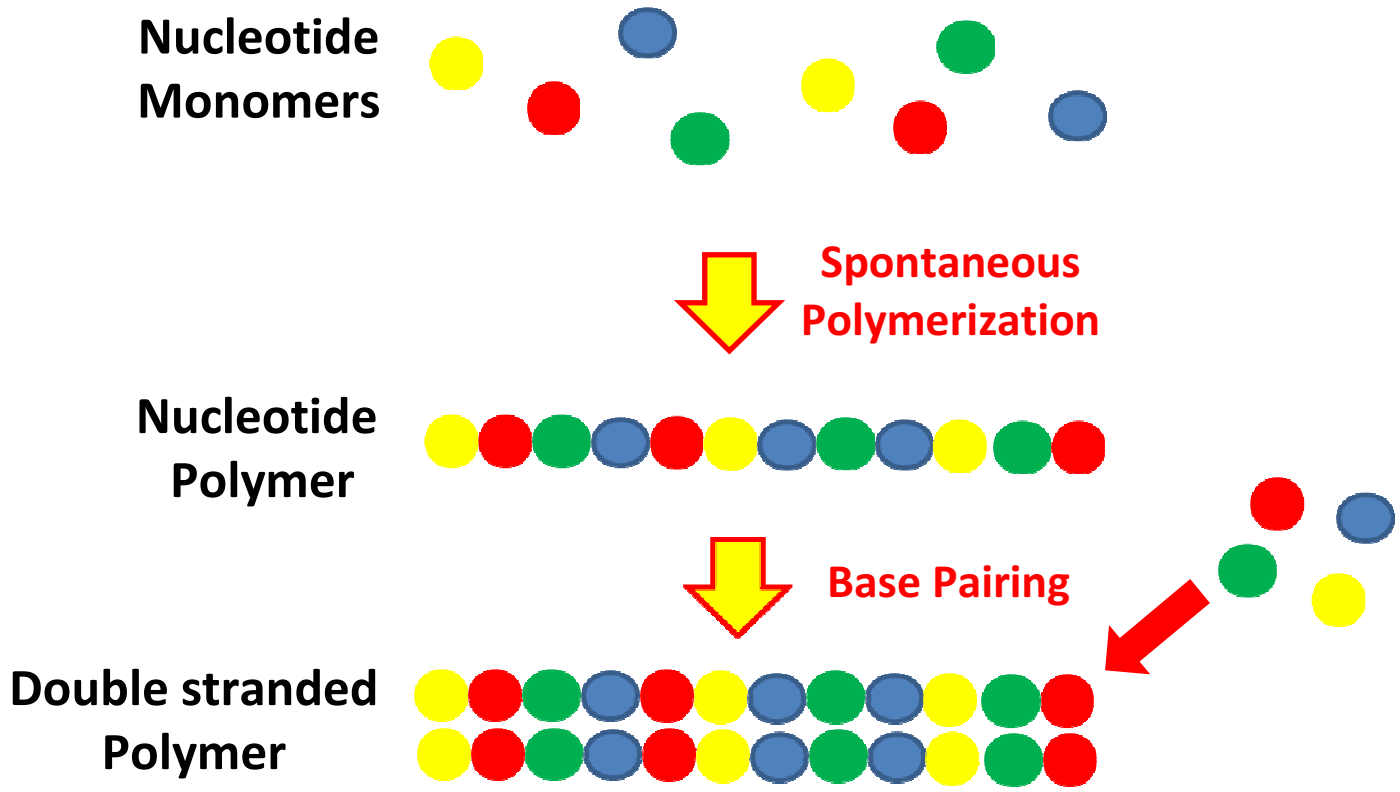
Organic Molecules in
the environment

Vesicle is permeable
to organic molecules

Vesicle growth

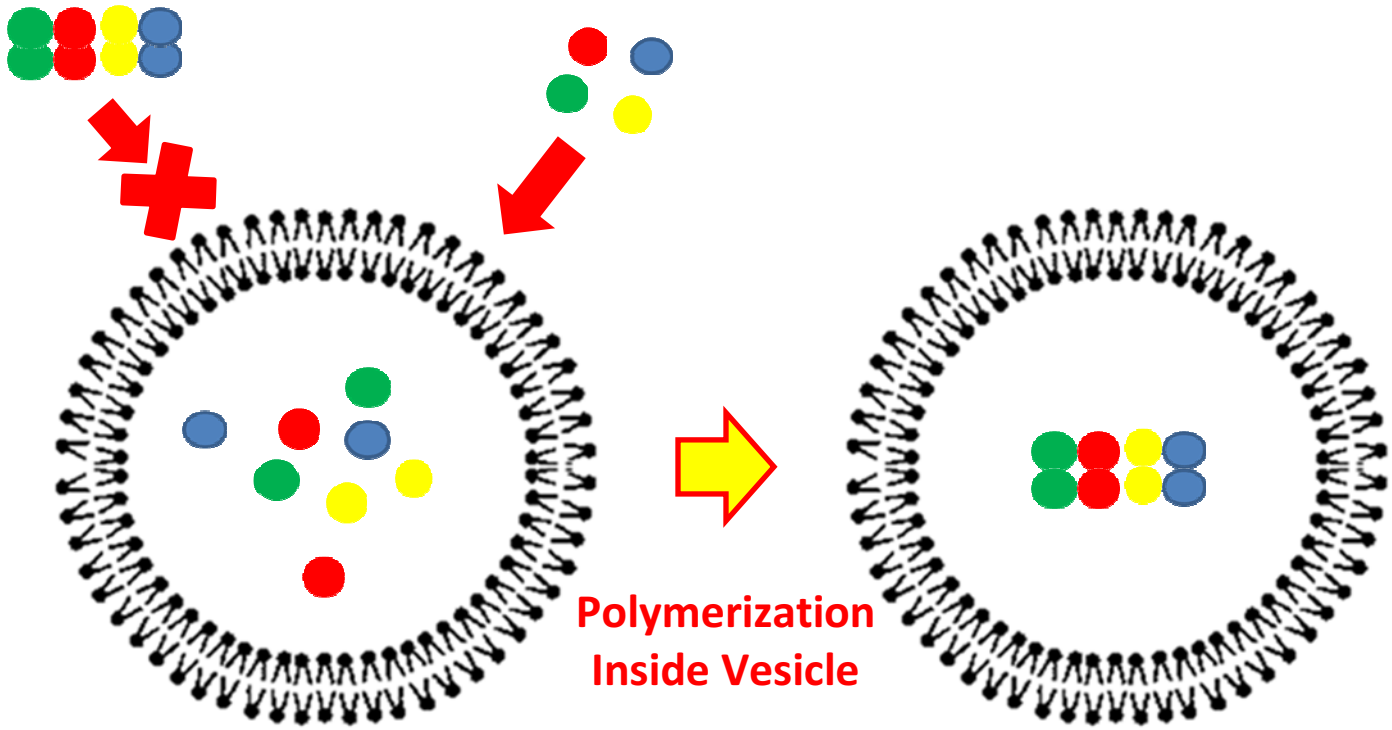


What about genetic material?



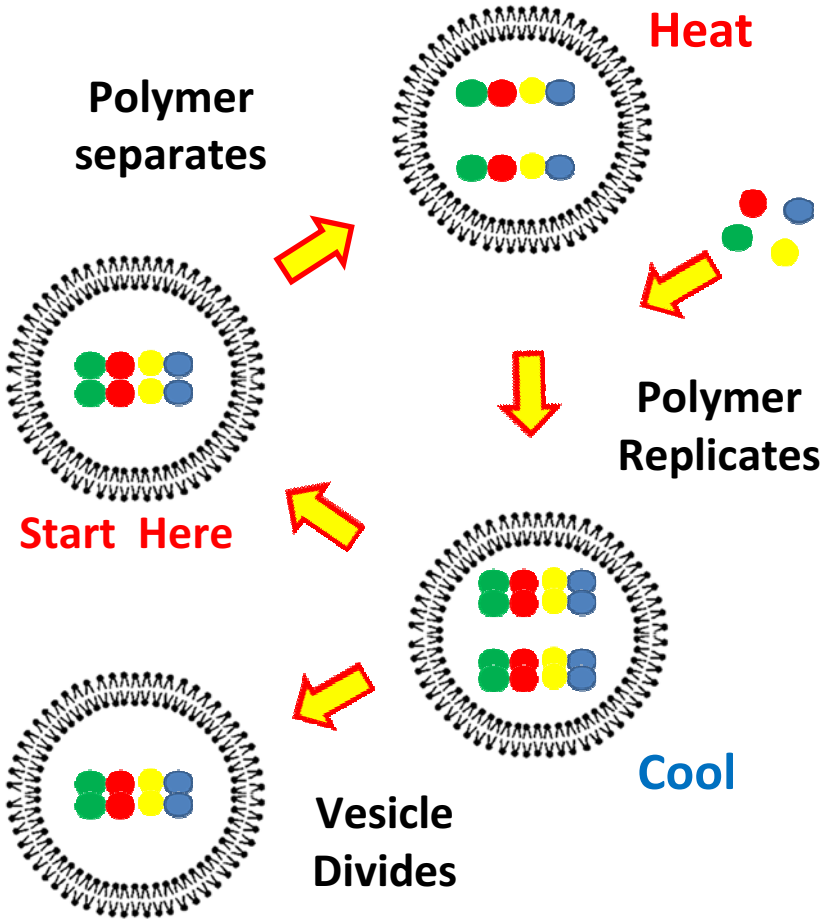
The early earth contained many different types of nucleotides

Putting the Components together

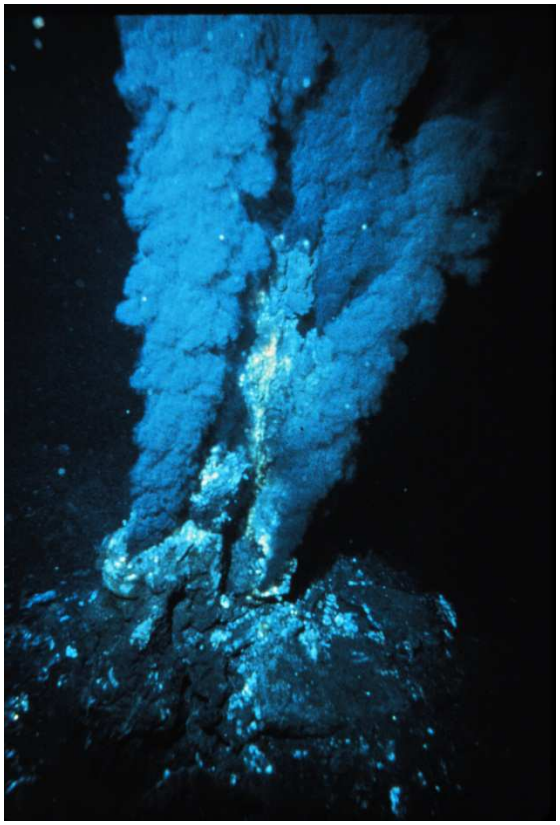


How does this become life?

How does the Polymer Replicate?

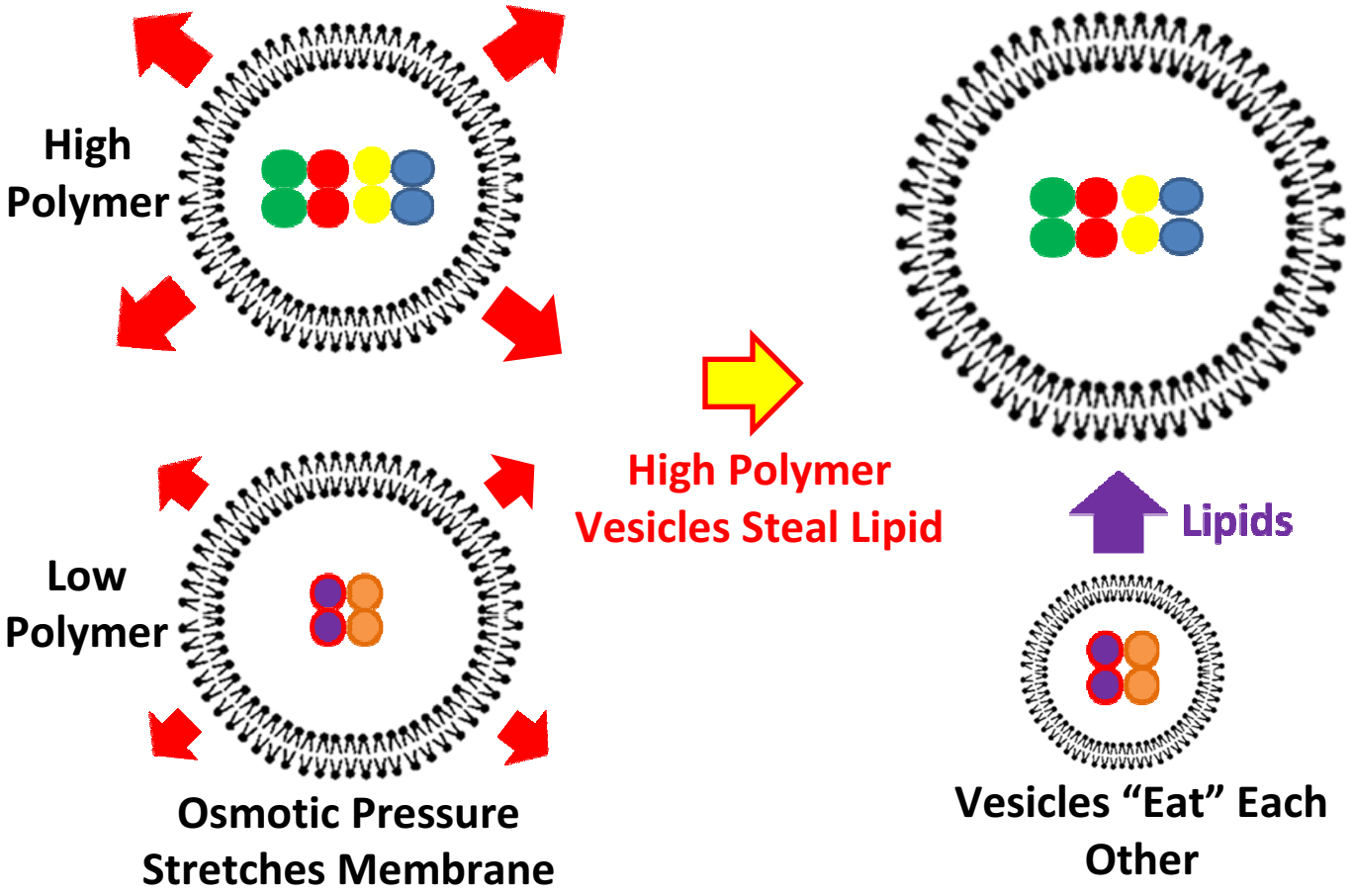


The basic requirement for life



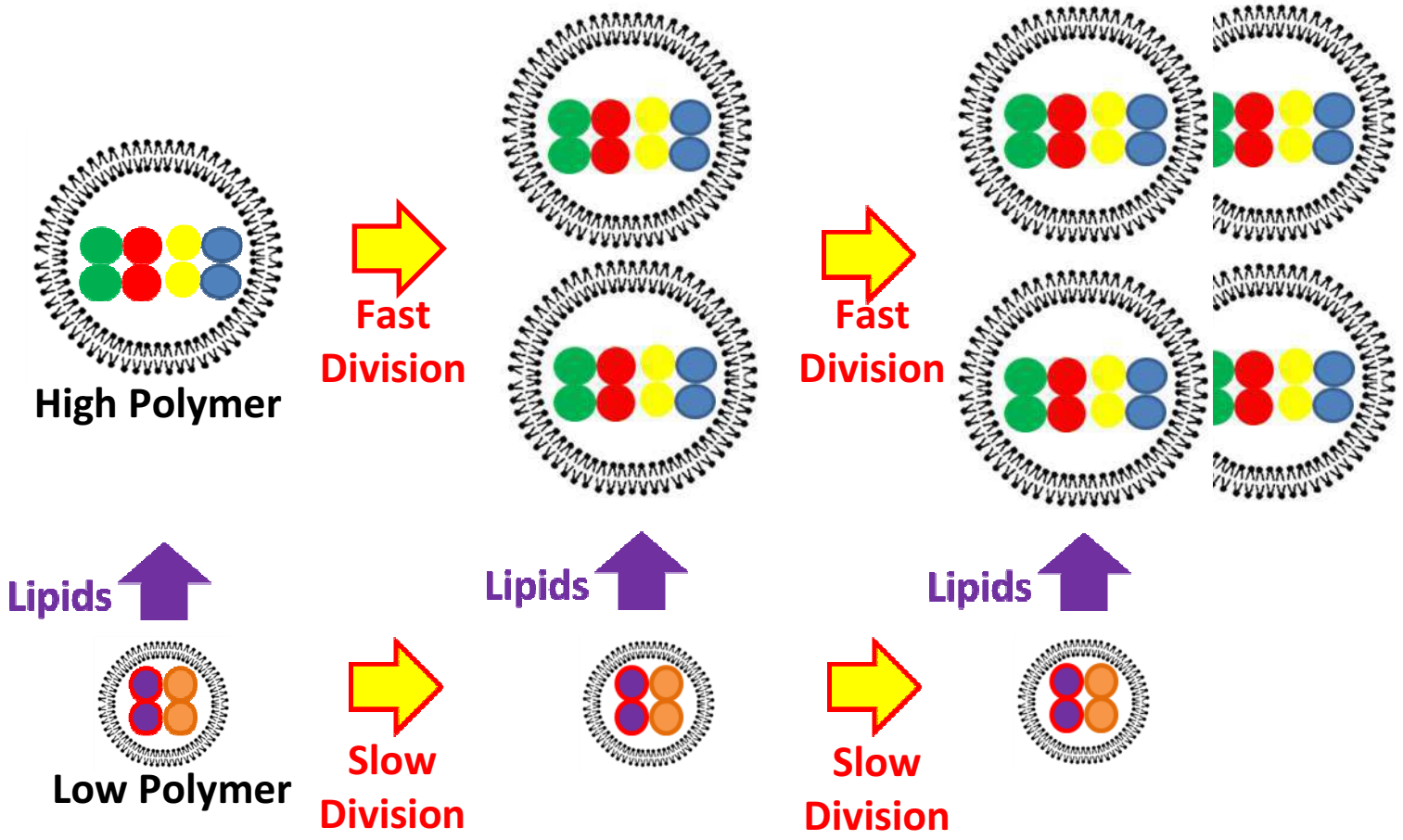
Heat from Thermal Vents Drives Replication

Polymer Drives Vesicle Growth

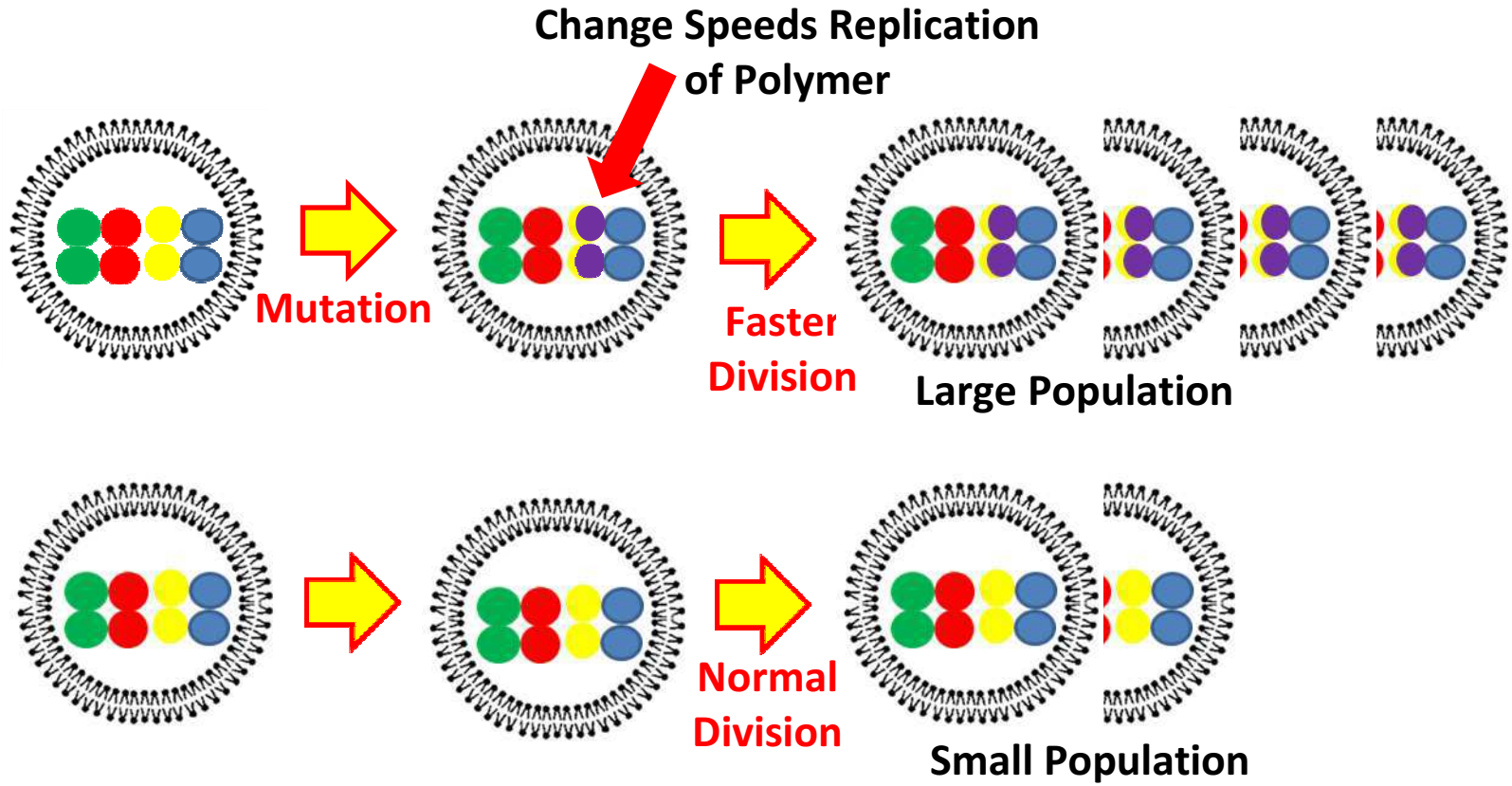


Here is where it gets really cool!

Origin of Competition



Mutations Increase Replication



Mutations that increase rate of replication are selected for

Life From Non-Life

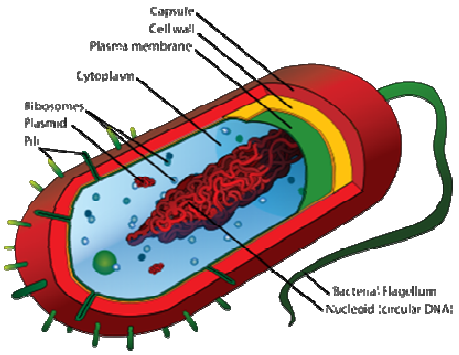
Polymer containing vesicle

Mutations Over Millions of Years

Simple Cells

Going from a polymer containing vesicles to simple cells

Thus begins evolution….



Primitive Life

Evolution

Advanced Life

Table Discussions: How Did Life Begin

1) Why is the origin of life such a controversial topic?

2) How did life begin?

3) How was God involved in the process?

4) Why is it important to avoid a God-of-the-Gap argument?

5) How can understanding the origin of life strengthen our faith?