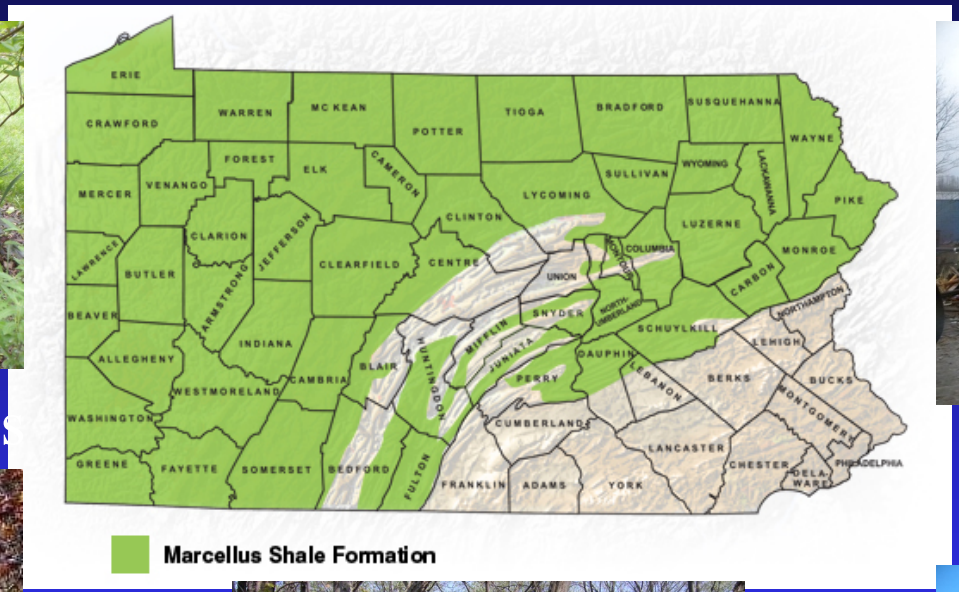
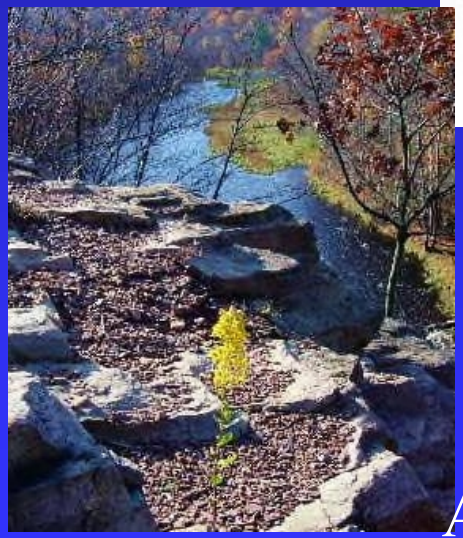
Pennsylvania Groundwater / Geology
Working Together as a Community

Water Resources

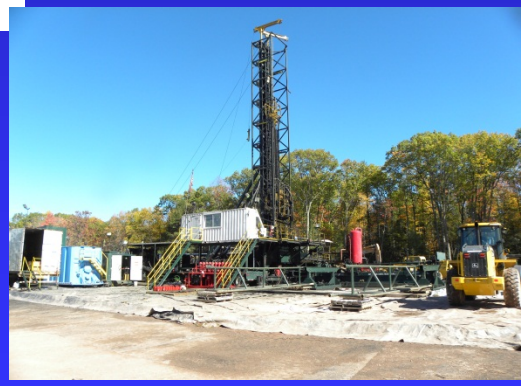


Old Issues



Environment

Actions for Citizens – Time to Step UP!
At Keystone College – June 2019



New Issues

Topic: The Big Blue Ball Was Not Always Blue!

- Introduction to Basic Geology of Pennsylvania
- Groundwater
- Water Cycle
- Climate Change Topics
- How the Earth Ends Up?

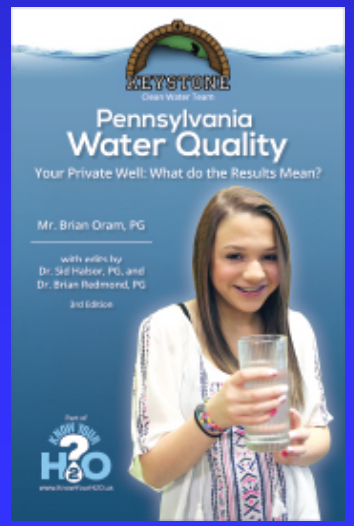
KEYSTONE
Clean Water Team

Keystone Clean Water Team – Education Outreach – Topic Watersheds/ Geology
June 2019

PACleanwater.org

Keystone Clean Water Team

Private Well Owner Education
Source Water Protection Issues
Alternative, Renewable, and Homegrown Energy Issues
Training Young Adults and Children about Energy and The Environment
Citizen Groundwater and Surface Water Database
Natural Gas and Baseline Water Testing – Training Professionals



Presented by:

Mr. Brian Oram, Professional Geologist (PG),
Soil Scientist, Licensed Well Driller

B.F. Environmental Consultants Inc.

http://www.bfenvironmental.com

And

Water Research Center- Free Information on Water Quality

http://www.water-research.net

B.F. Environmental Consultants Inc.

- Professional Consulting Services in the areas of water quality, soils, stormwater, geology, aquifer analysis, and land-development.
- Baseline – Chain-of-Custody
- Expert Testimony
- Water Treatment Process/ Product Development
- http://www.bfenvironmental.com

Water-Research Center

Education and Outreach Program funded by

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Outreach Programs

- Environmental and Professional Education and Training for Citizens and Local Municipalities
- Water Quality Help Guides – Information Library
- Community and Business Outreach Programs
- Low Cost – Informational Water Testing Program with National Laboratory
- Citizen Monitoring Programs

Websites:
http://www.water-research.net
http://www.pacleanwater.org

Presentation Sponsors

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- Test Assured
  http://www.watertestingkits.com/ref/10

Geology is? From the Greek - *gē* ("earth") and, *-logia*, ("study of‟ or "discourse")

- a science that deals with the history of the earth and its life especially as recorded in rocks
- a study of the solid matter of a celestial body (such as the moon)
- Source: merriam-webster.com

Or

- the science that deals with the dynamics and physical history of the earth, the rocks of which it is composed, and the physical, chemical, and biological changes that the earth has undergone or is undergoing.
- Source: www.dictionary.com

Where to Start?

The Big Blue Ball Was Not Always Blue!

- The age of the Earth is 4.54 ± 0.05 billion years (Calculated Estimate based on a Galaxy Age of 11 to 13 billion years).
- Created from the remnants of 2nd – 3rd generations stars and 2nd+ generation planets.
- Moon was formed by the collision of Earth with a Mars-sized protoplanet and help form the core our planet and our current tilt the Earth.
- Earth has plate tectonics – Moon does not.
- Source: USGS

Early Earth – Gaia (1 billion years)

- Hadean Eon – 4.5 to 4 billion years (hā-ˌdē-ən)

Earth was hell! Earth covered in molten lava. Earth was hit by asteroids, comets and foreign objects left, right and center.

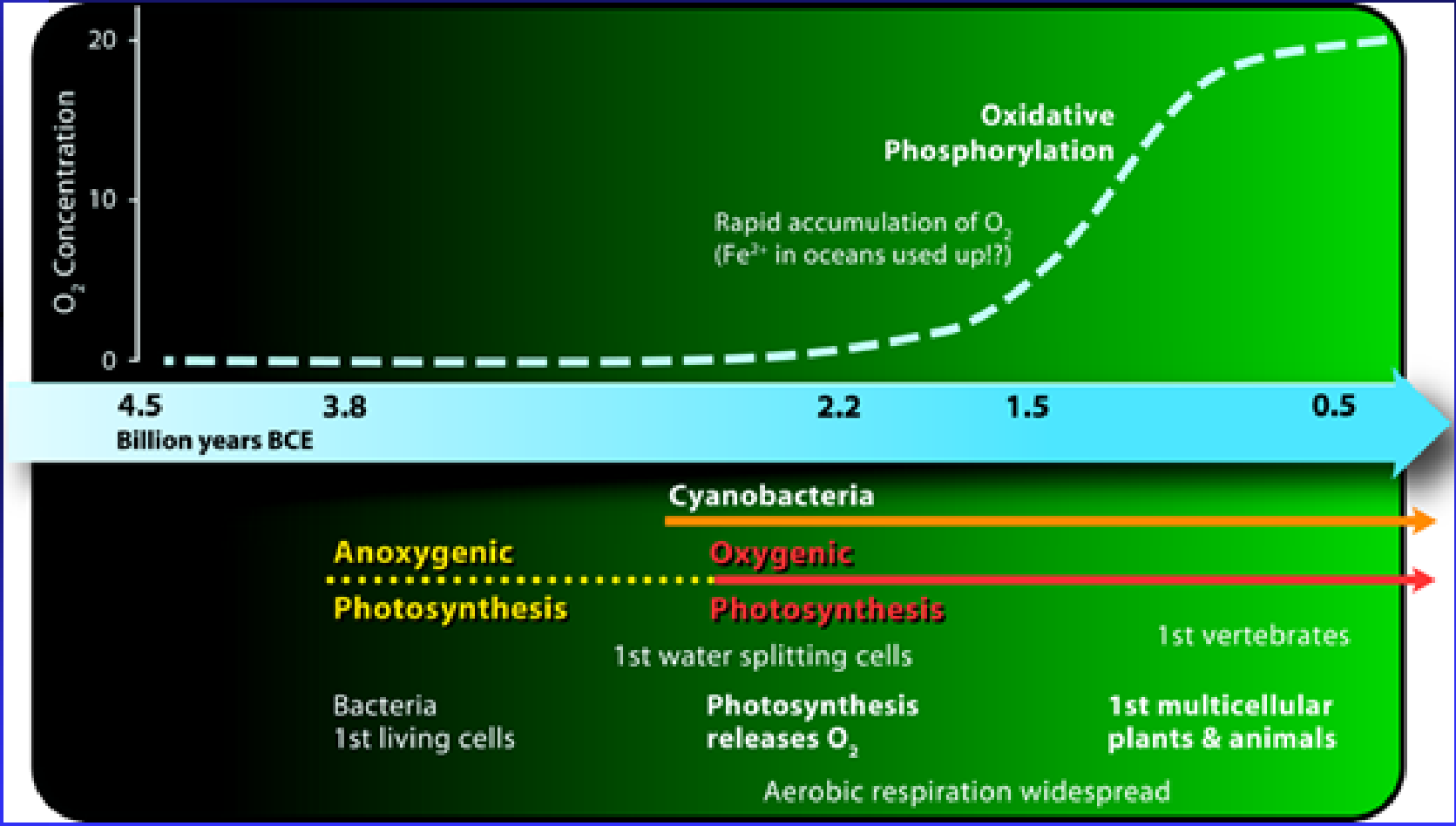
- Archean Eon 4.0 to 2.5 billon years (är-ˈkē-ən)

Earth started to cool down/ Single cell life. Water vapor condensed to form oceans. The Earth cooled down enough to create continents. No free Oxygen – "Green Planet". Oxygen rising - First Global Glaciation – 2.8 to 2.9 billion years ago.

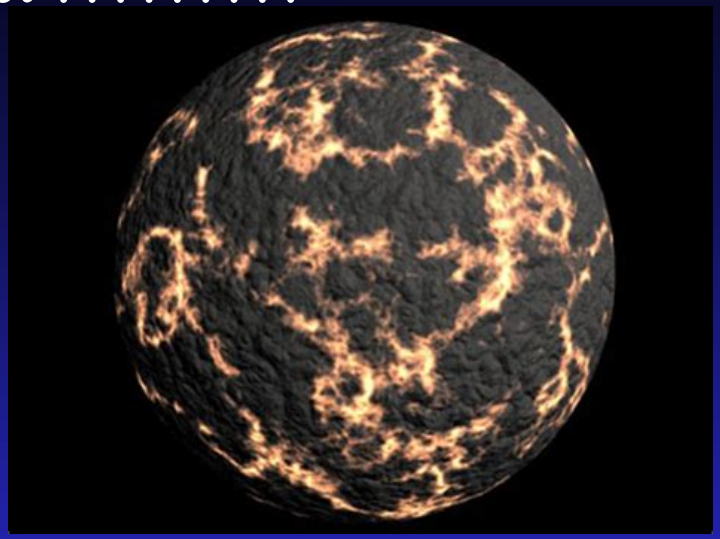
- Proterozoic Eon 2.5 billion to 540 million years (prä-tə-rə-ˈzō-ik)

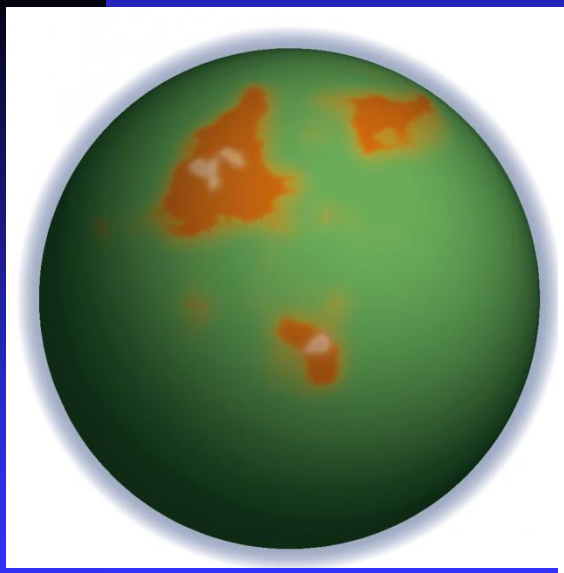
Near the end about 2.45 billion years, Great Oxygenation Event, Free oxygen trigger greenhouse gases issues – More Glaciation - The Snowball to Shush Earth and eukaryotes and multicellular organisms appeared on Earth and ozone layer became stable.

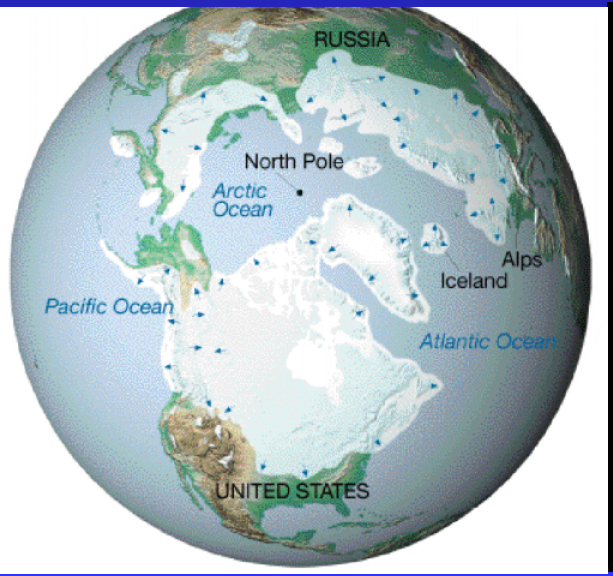
Oxygen Made a Big Change



Our Stable Planet ?????????





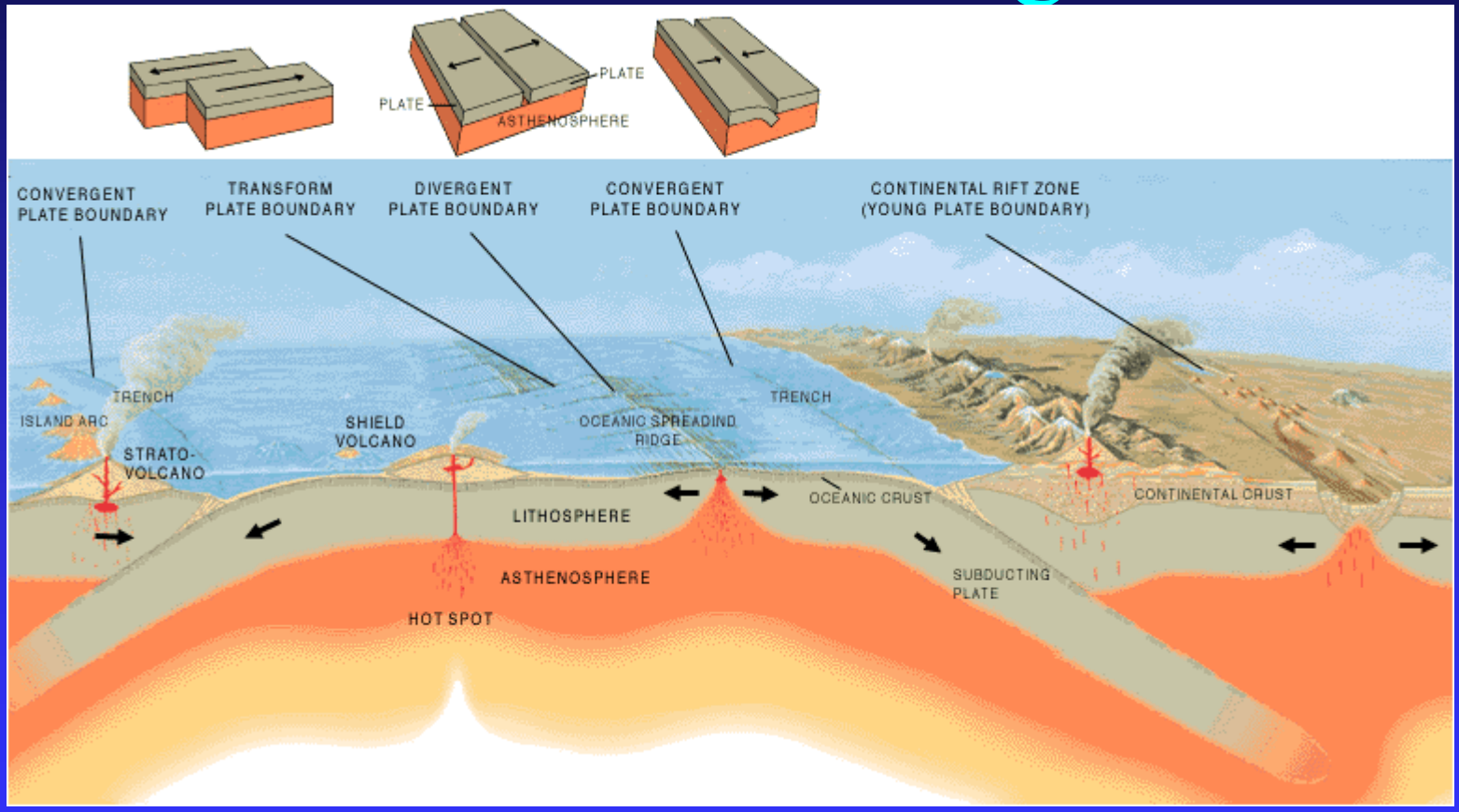


More Oxygen

18,000 yrs ago

NOW

Plate Tectonics:
"The Plates are Moving"



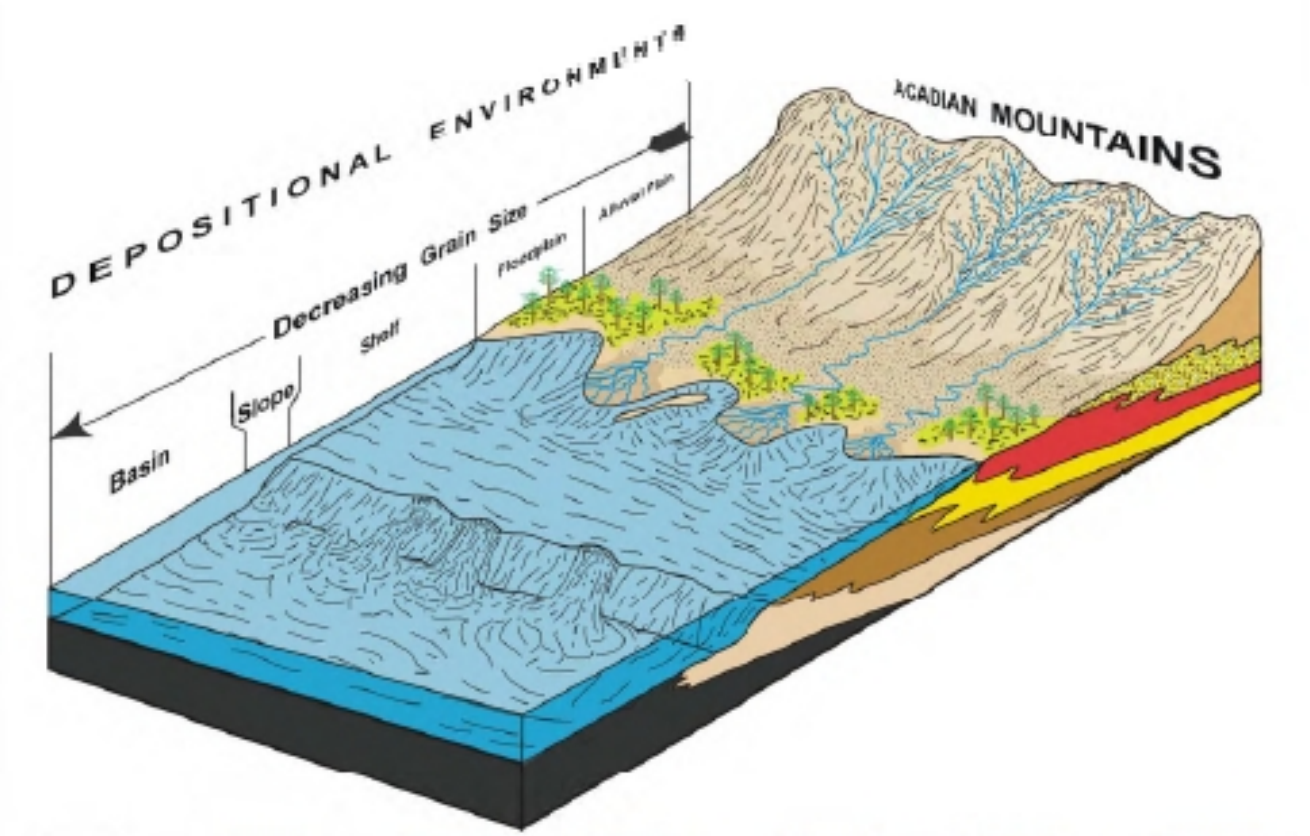
Recycling on a mass scale.


385 Million Years Ago
N
Pennsylvania
Source: http://www2.nau.edu/rcb7/nam.html

Point a Few Things Out (last slide)

- Part of Pennsylvania Under Water.
- Part of Pennsylvania Very Mountainous
- Notice Where the Equator is Located.
- The plates are moving !
- The nature of the Earth is not fixed, it changes, through a process associated with plate tectonics, recycling the planet.

DEVONIAN DEPOSITIONAL ENVIRONMENTS

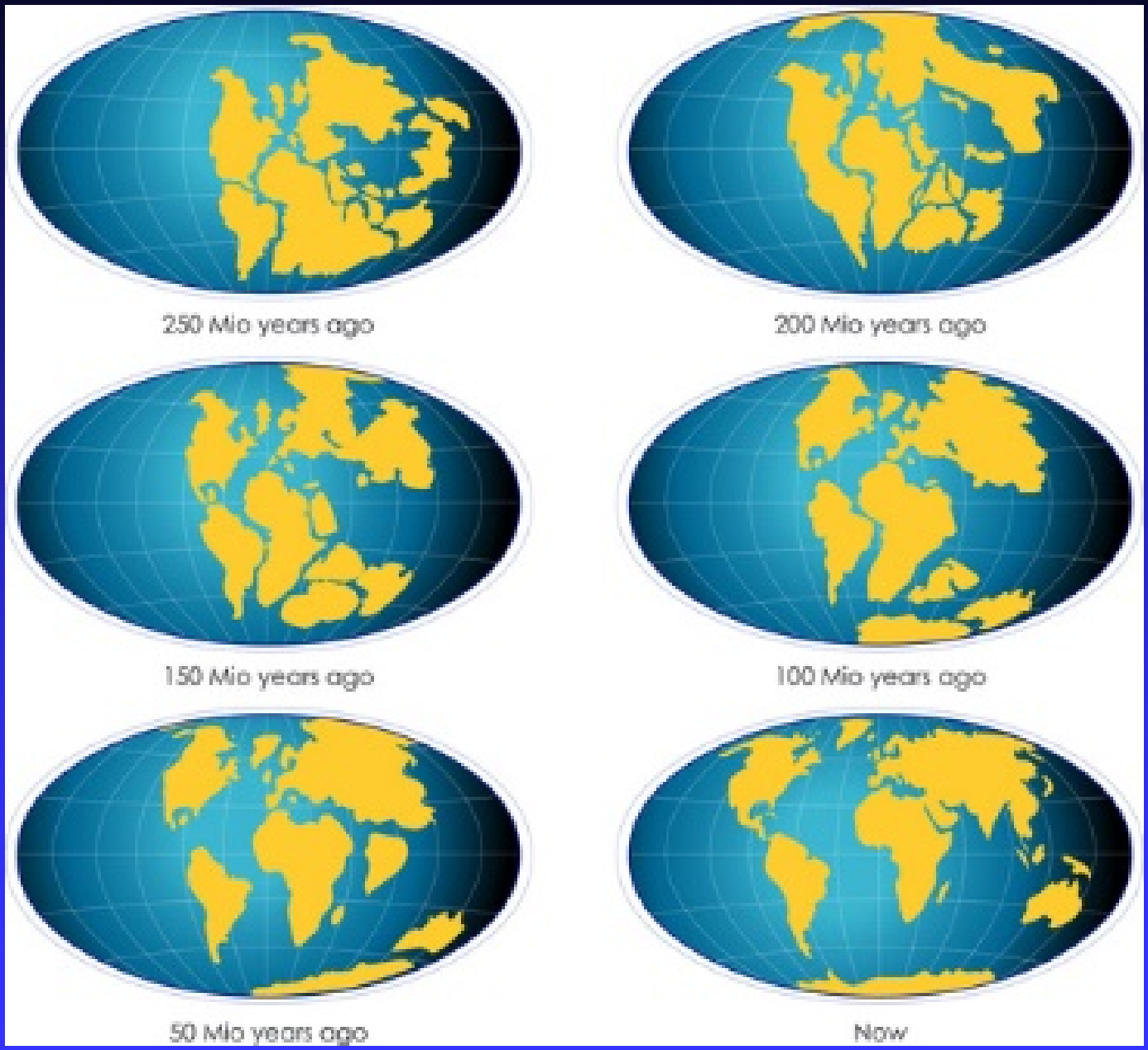


Modified from Laughrey, 2009

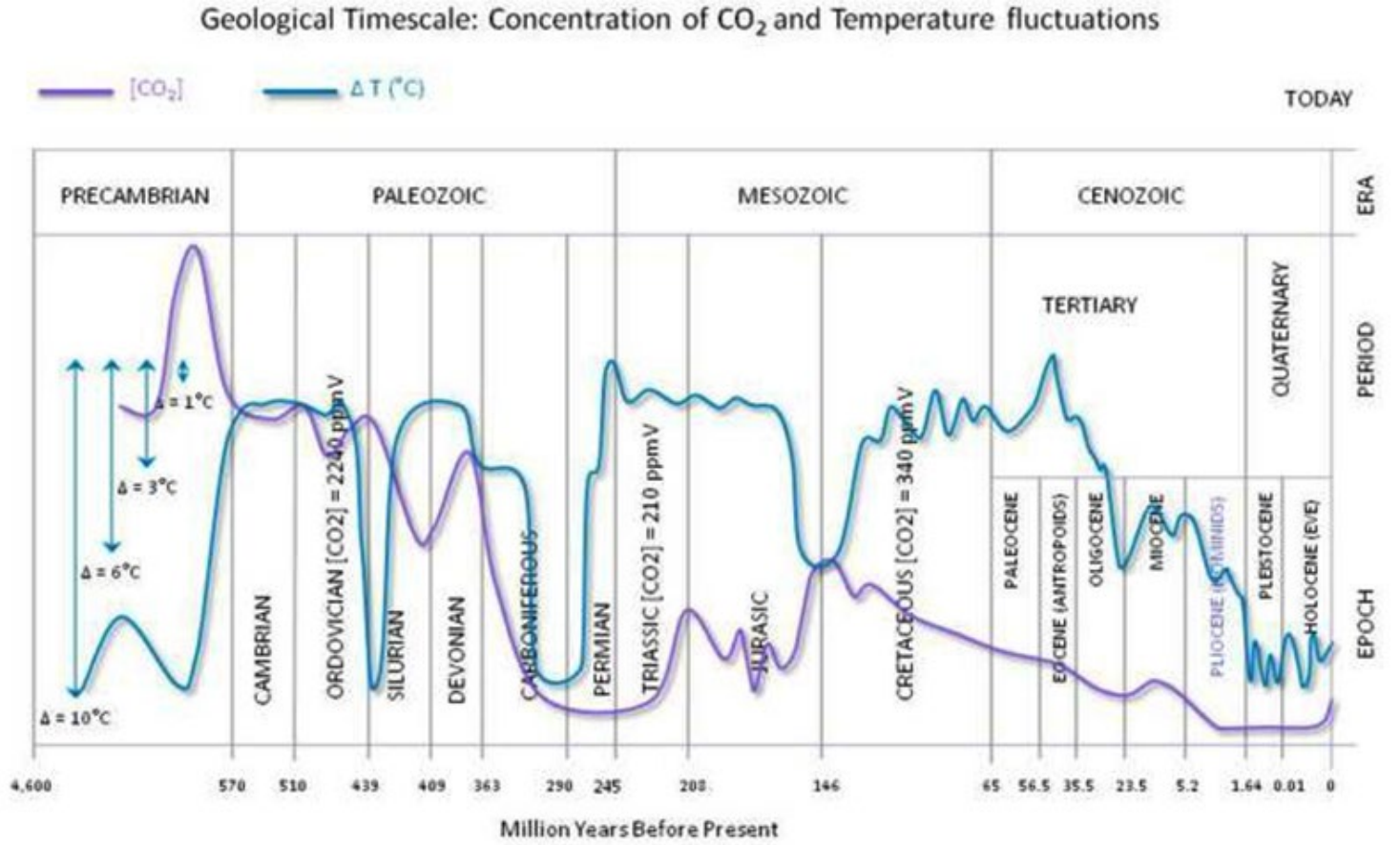
Geological Sequence – Northeast PA

OLDER

Time	Period	Deposit or Rock Type
0 to 1.8 million years	Quaternary – Glaciation	sand, silt, clay, and gravel
1.8 to 290 million	Tertiary to Permian	**Not present (eroded and weathered)**
290 – 320 million	Pennsylvanian	**Llewellyn (coal) and Pottsville (minor coal)**
320 – 354 million	Mississippian	**Mauch Chunk Pocono and Spechty Kopf**
354 - 417 million	Devonian	Catskill Formation **Lockhaven , Elk, Tully Mahantango Formation Marcellus Formation (Black Shale)- Target Onondaga Formation (calcareous sandy shale)**
417 – 443 million	Silurian	

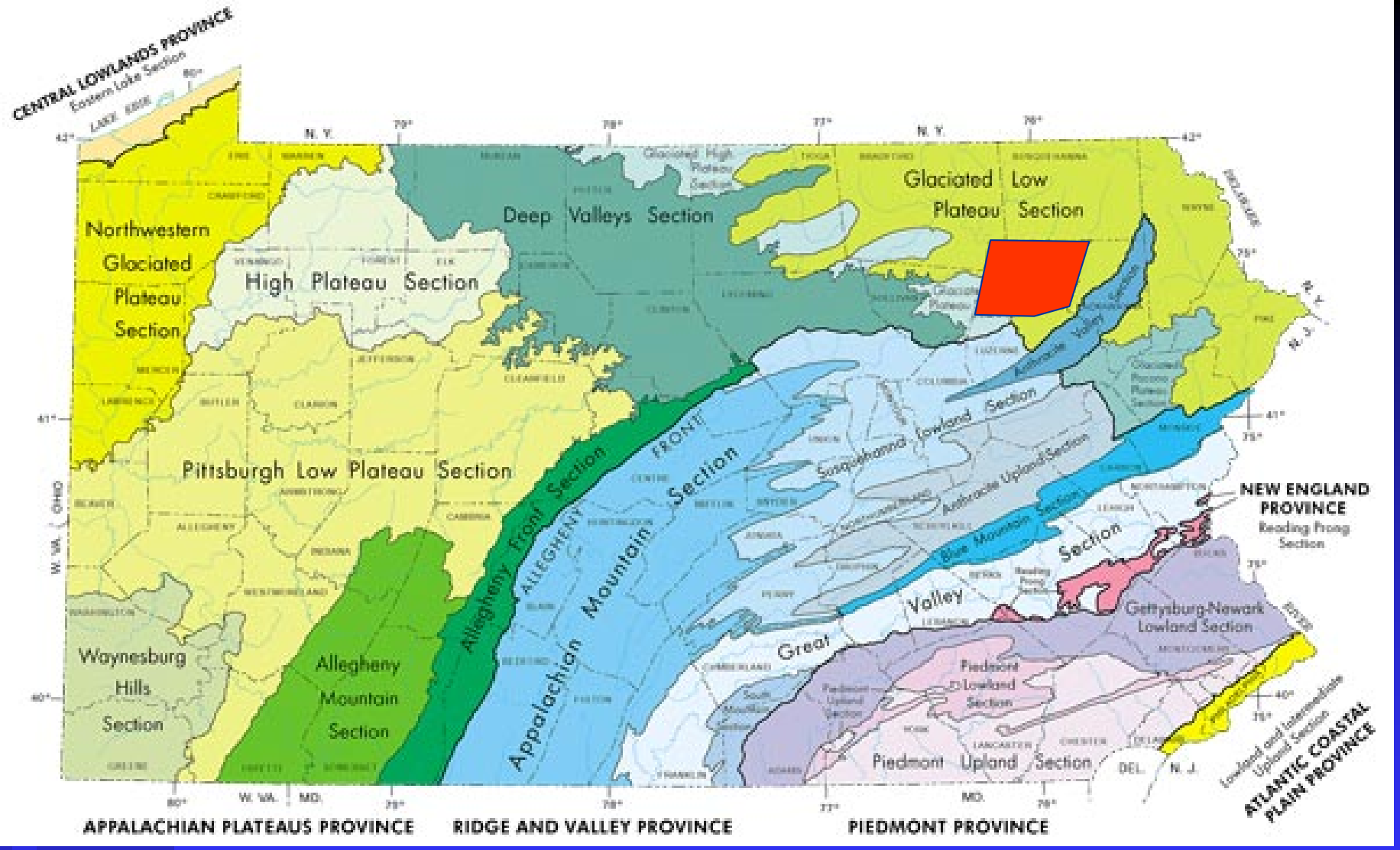

250 Mio years ago
200 Mio years ago
150 Mio years ago
100 Mio years ago
50 Mio years ago
Now

Earth Temperature / CO2



1- *Analysis of the Temperature Oscillations in Geological Eras* by Dr. C. R. Scotese © 2002. 2- Ruddiman, W. F. 2001. *Earth's Climate: post and future*. W. H. Freeman & Sons. New York, NY. 3- Mark Pagani *et all*. *Marked Decline in Atmospheric Carbon Dioxide Concentrations During the Paleocene*. Science; Vol. 309, No. 5734; pp. 600-603. 22 July 2005.

Corrected on 07 July 2008 (CO2: Ordovician Period).



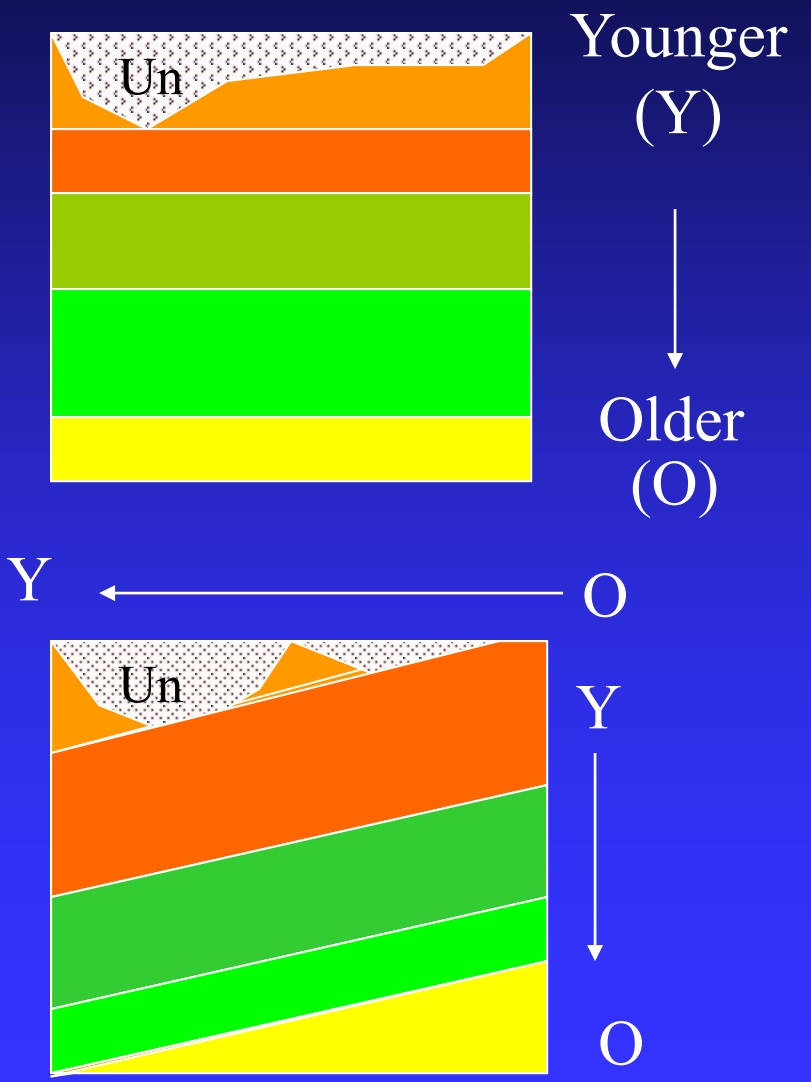
Wyoming County was glaciated and it is located within are within the Appalachian Plateau

Source: DCNR - http://www.dcnr.state.pa.us/topogeo/map13/map13.aspx

Appalachian Plateau Province

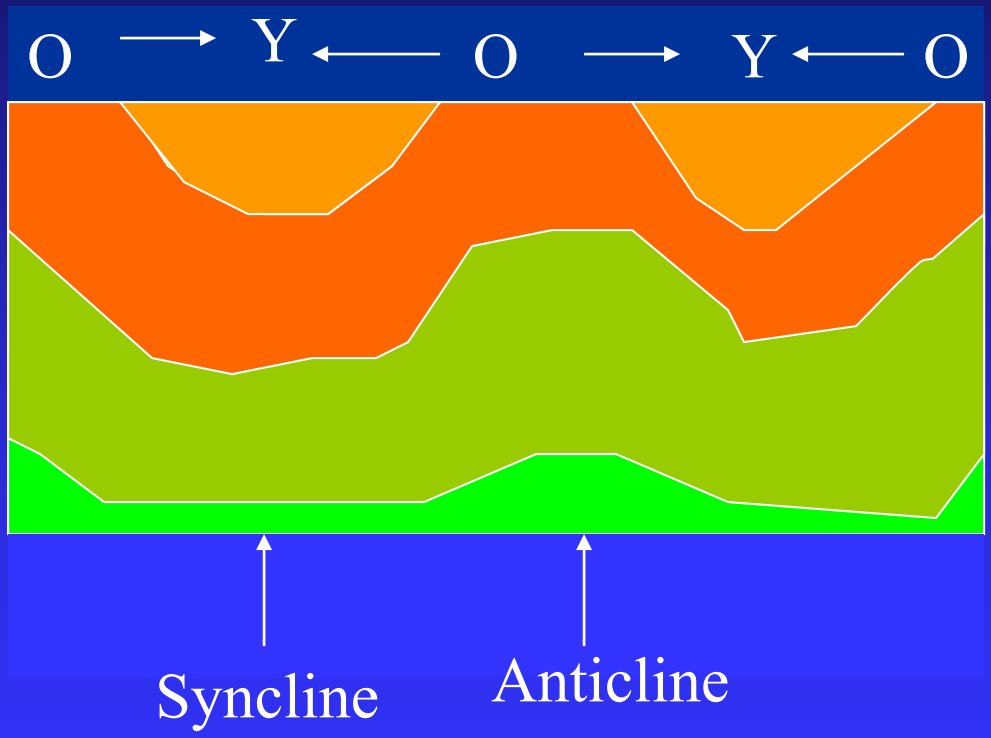
- Broad to Narrow Valleys
- Rounded Hills and Valleys Associated with Glaciation
- Valleys filled by glacial fluvial material

Unconsolidated Material (Un)



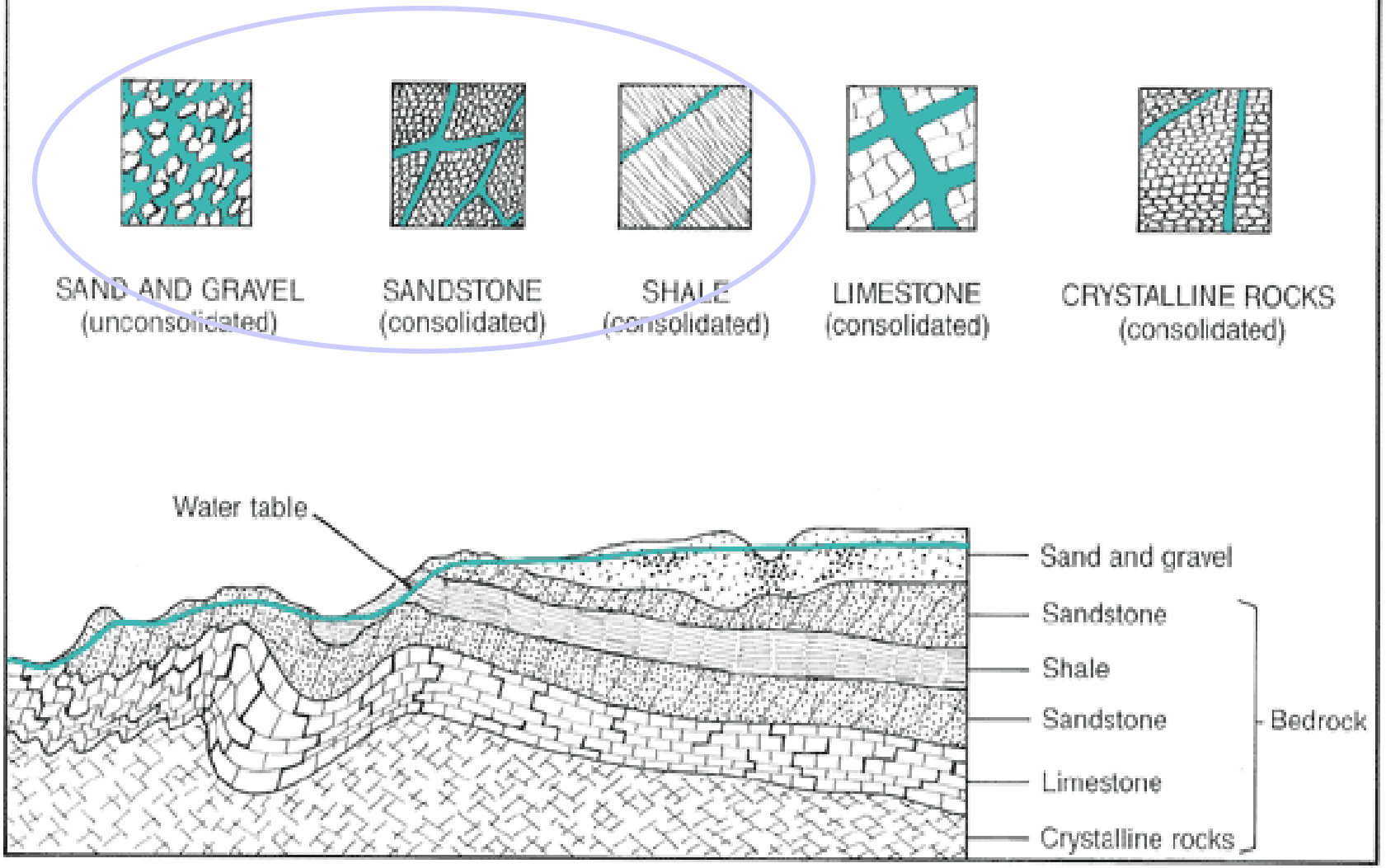
Ridge and Valley Province

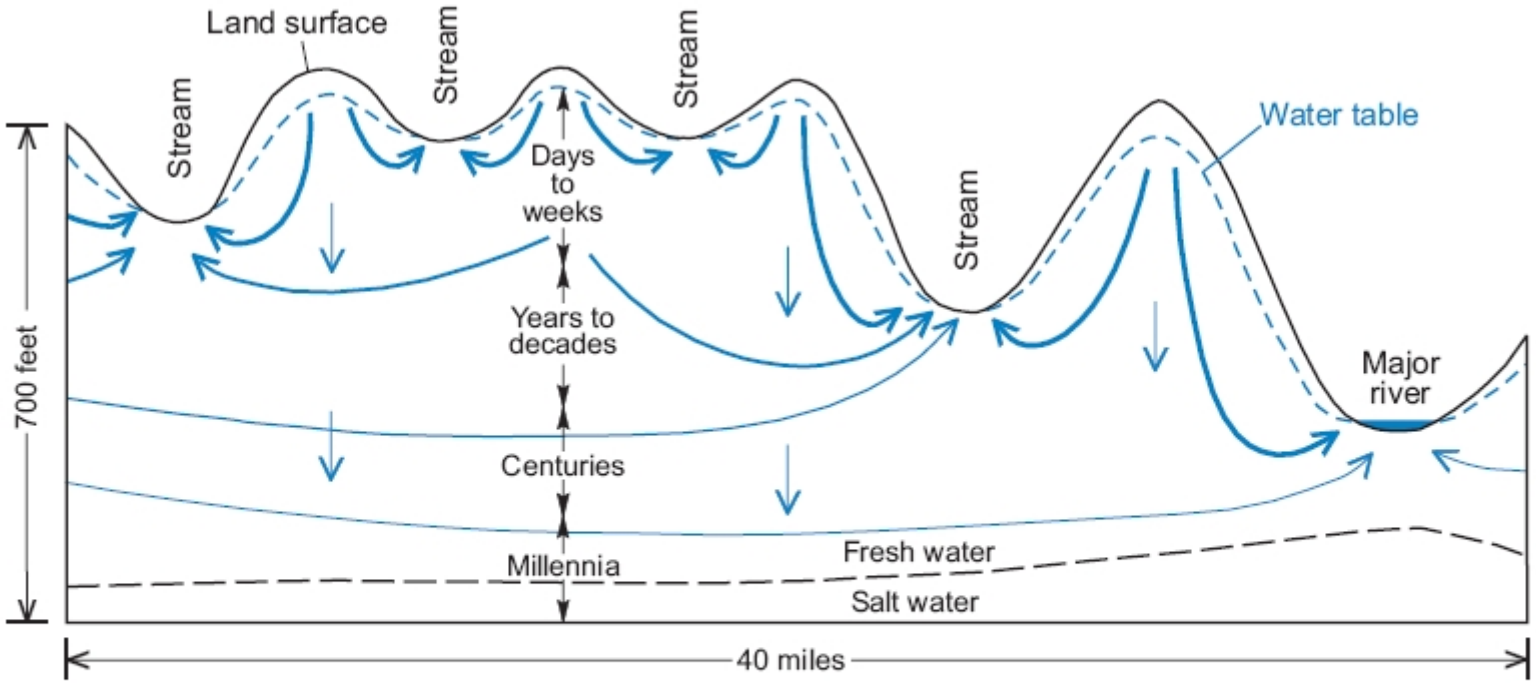
- Bedrock has been folded into a series of anticline and synclinal structures.



Edge Ridge and Valley Province – Rt 309- Dallas, PA

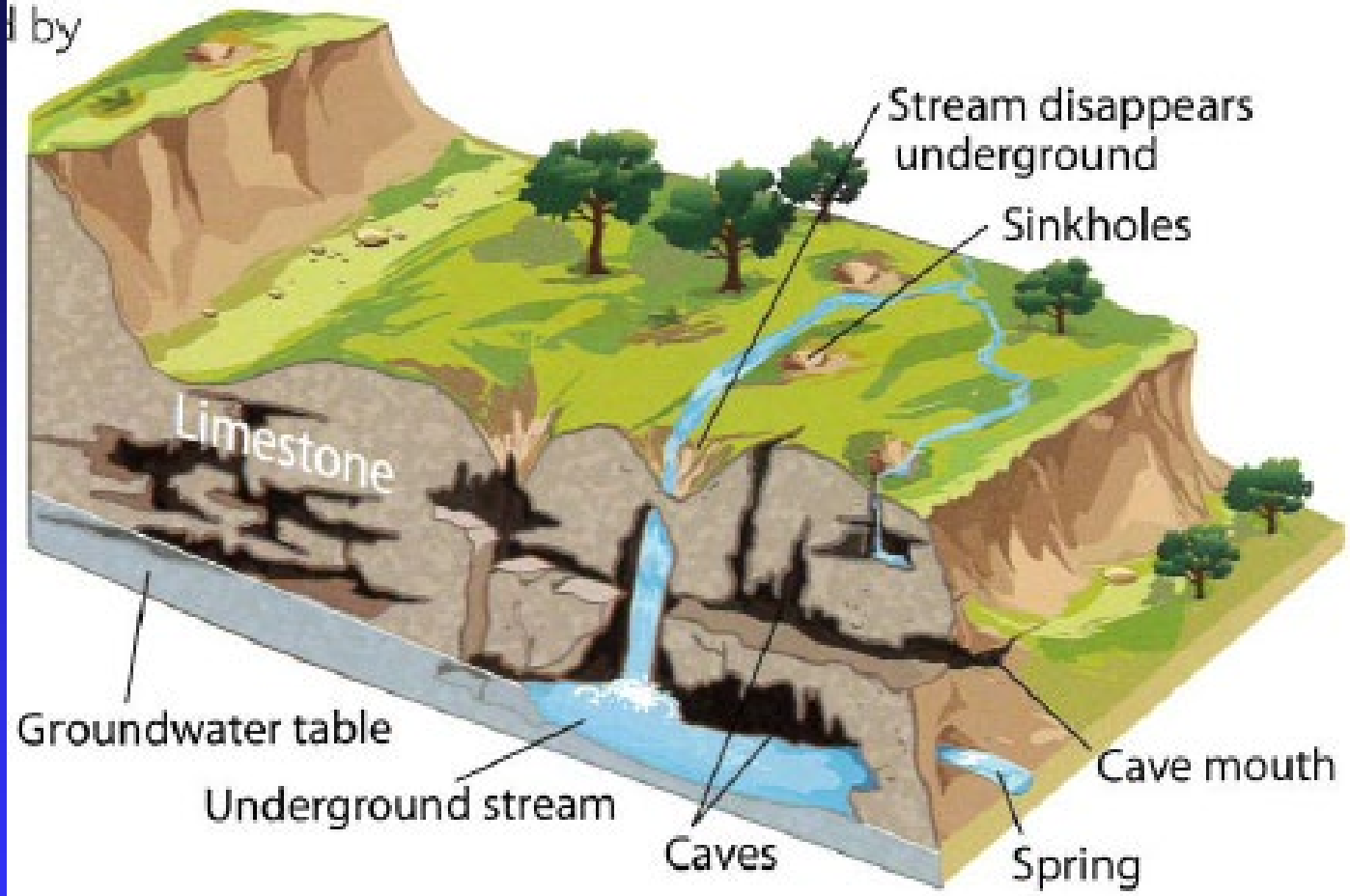
Primary Aquifers in PA





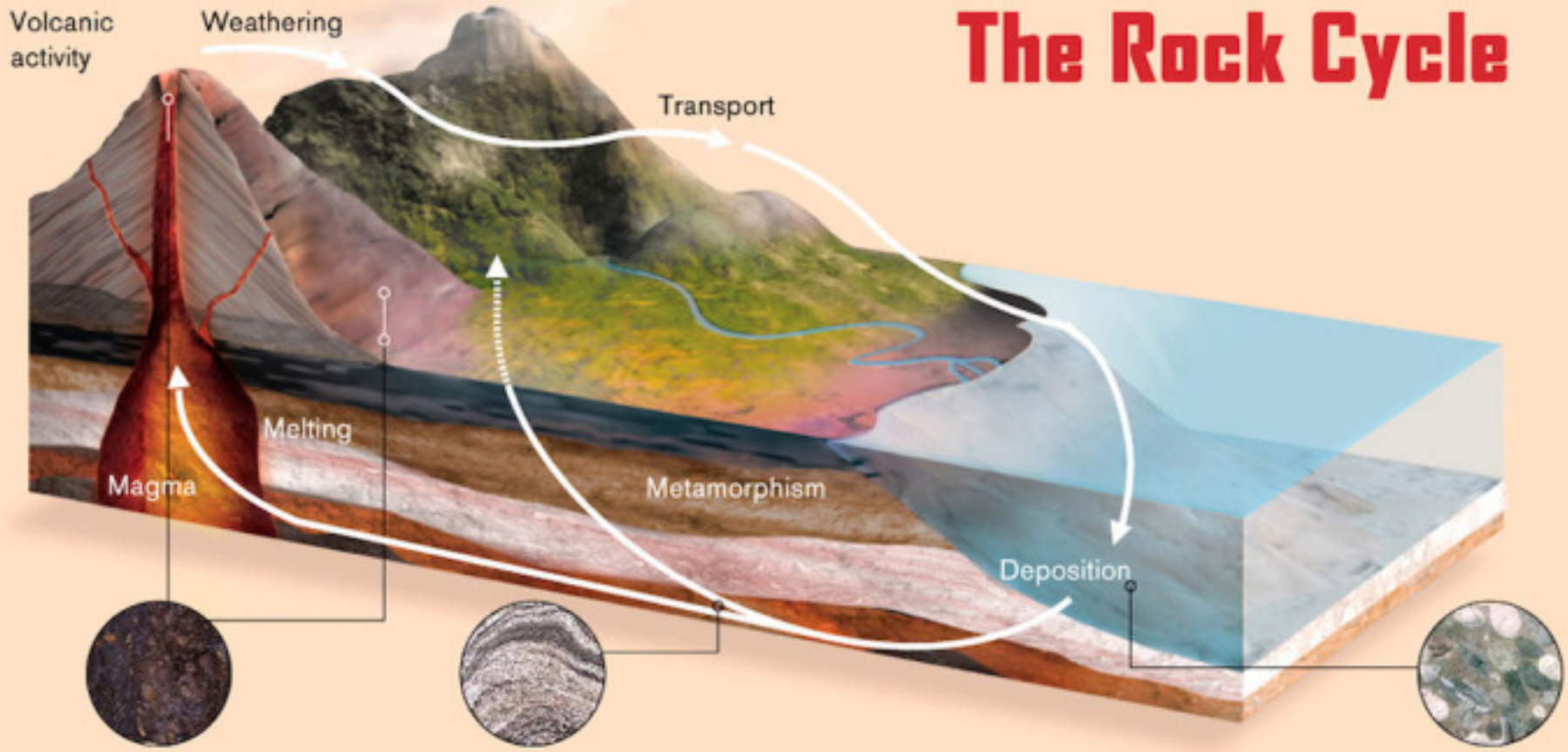
Groundwater flow paths (indicated by the blue arrows). The thickness of the lines reflect the relative amount of groundwater flowing through the groundwater system.

Karst Landforms and the Erosion Cycle



E5

The Rock Cycle



Igneous rock

These rocks are formed when magma (molten rock) from the Earth's interior cools and solidifies.

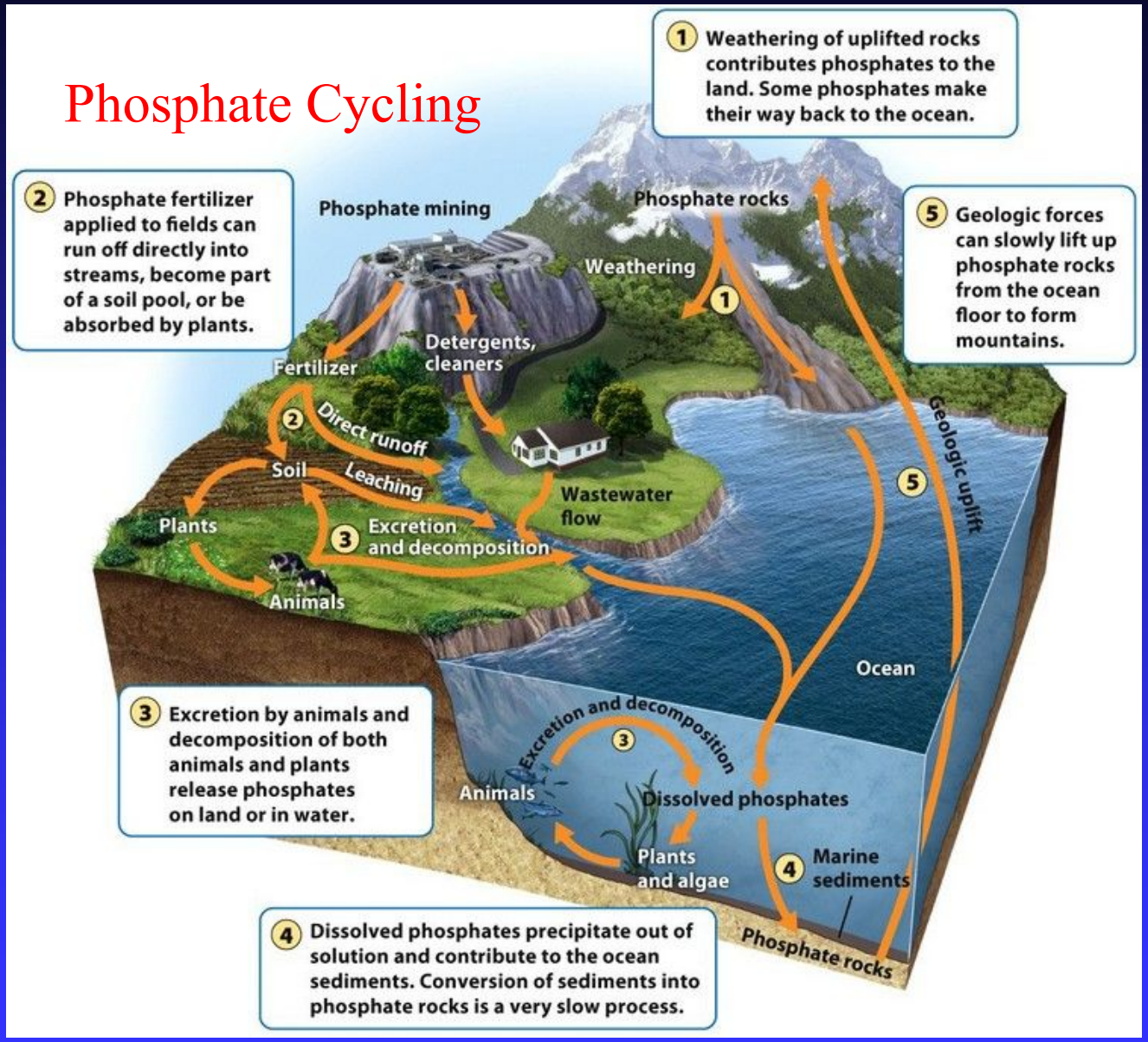
Metamorphic rock

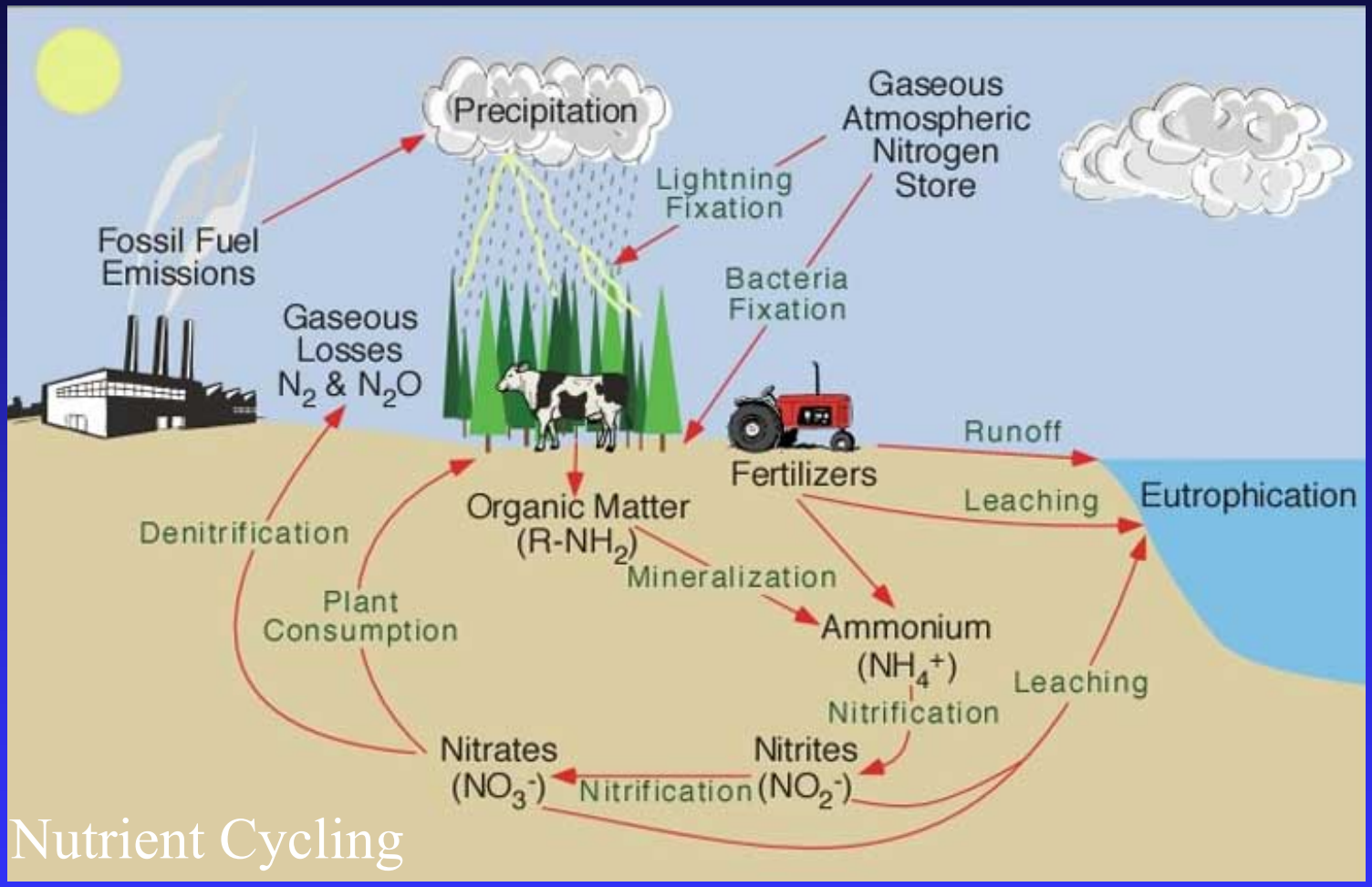
The heat and pressure of the Earth's interior transform igneous and sedimentary rocks into metamorphic rocks.

Sedimentary rock

Atmospheric agents erode and transport igneous rocks to the seabed, where they are compressed and merged with others into sedimentary rocks.

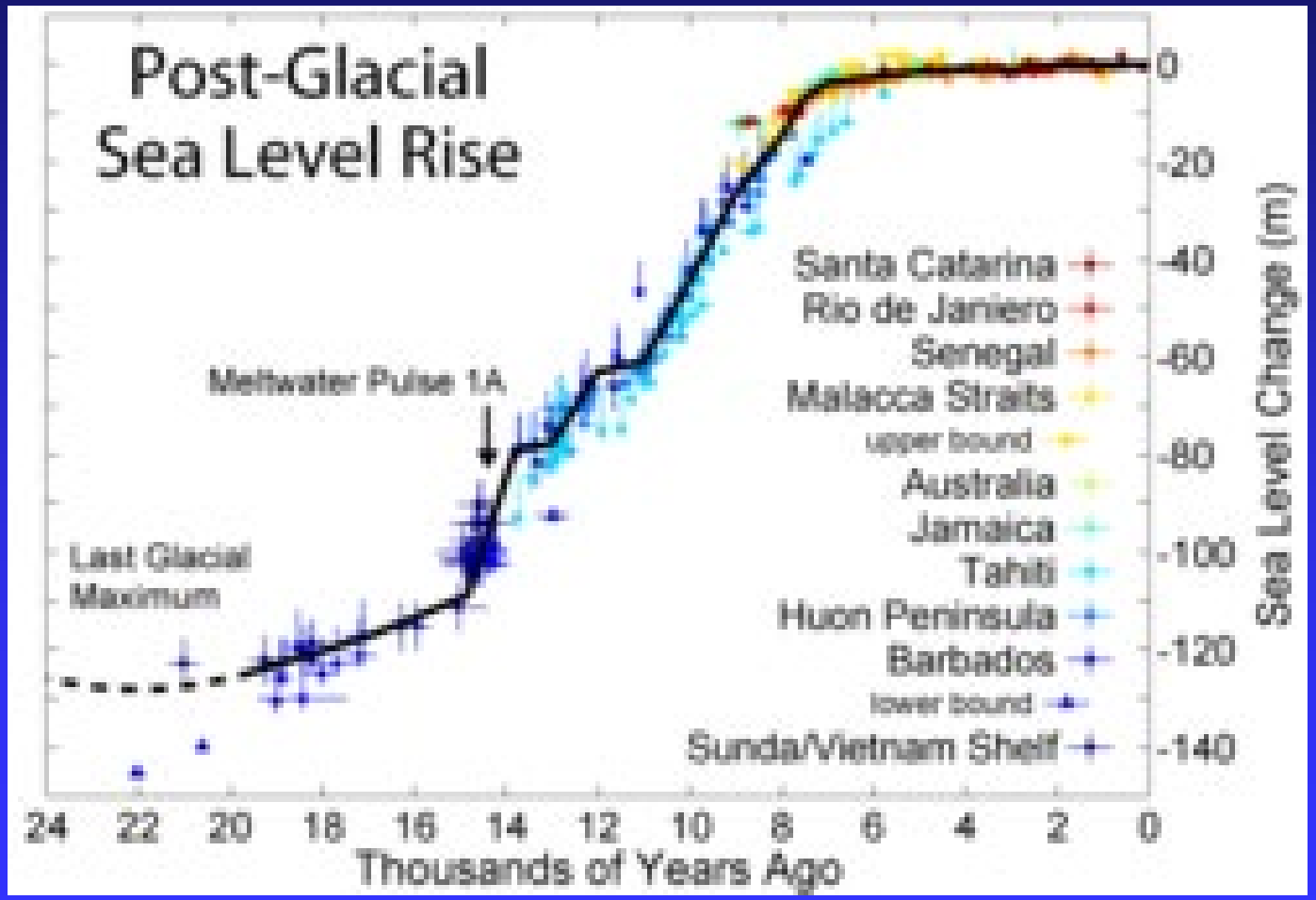
Phosphate Cycling

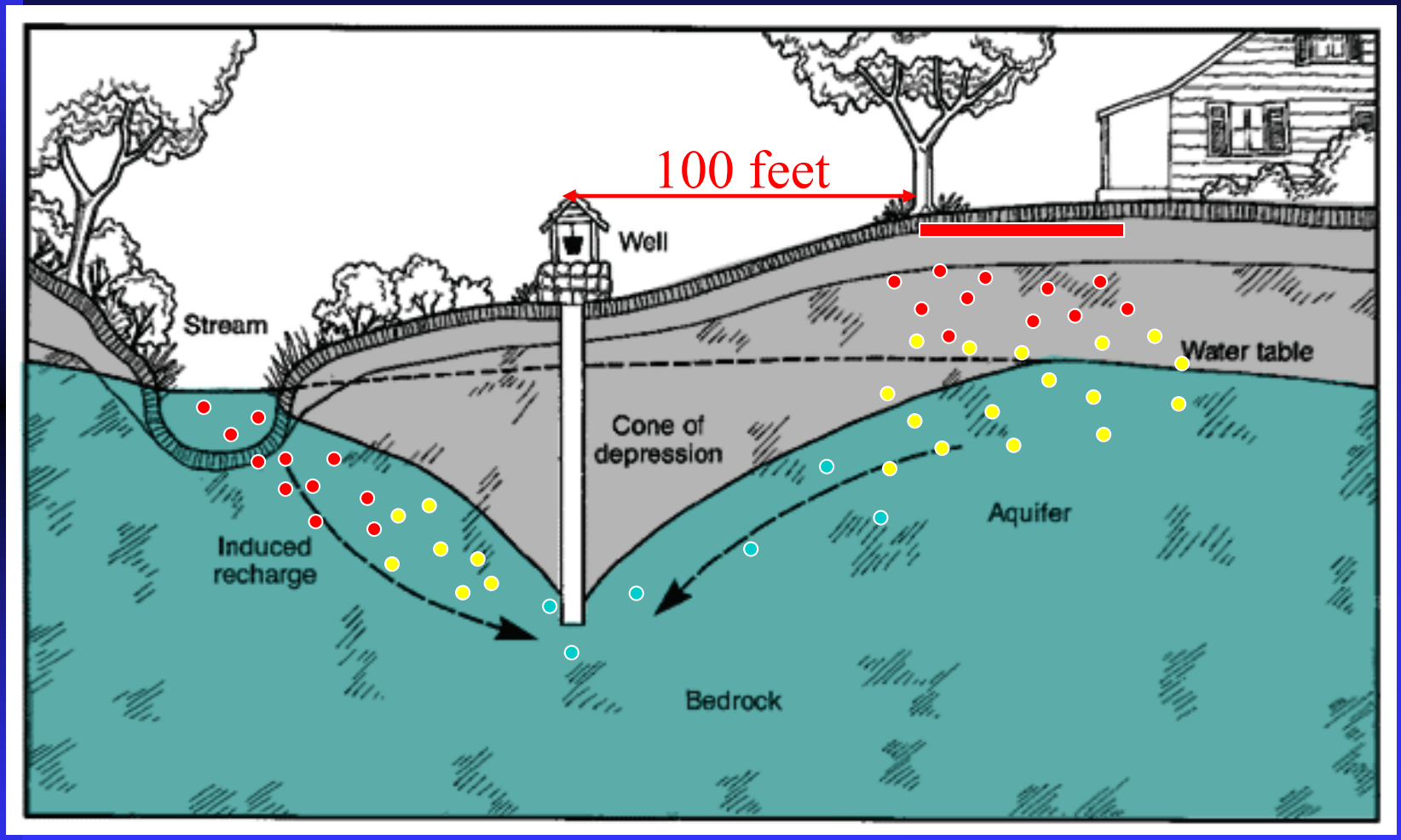




Nutrient Cycling

Sea Level – Recent History





Is 100 feet enough? Maybe, but for how long?

Contaminated

Not Contaminated

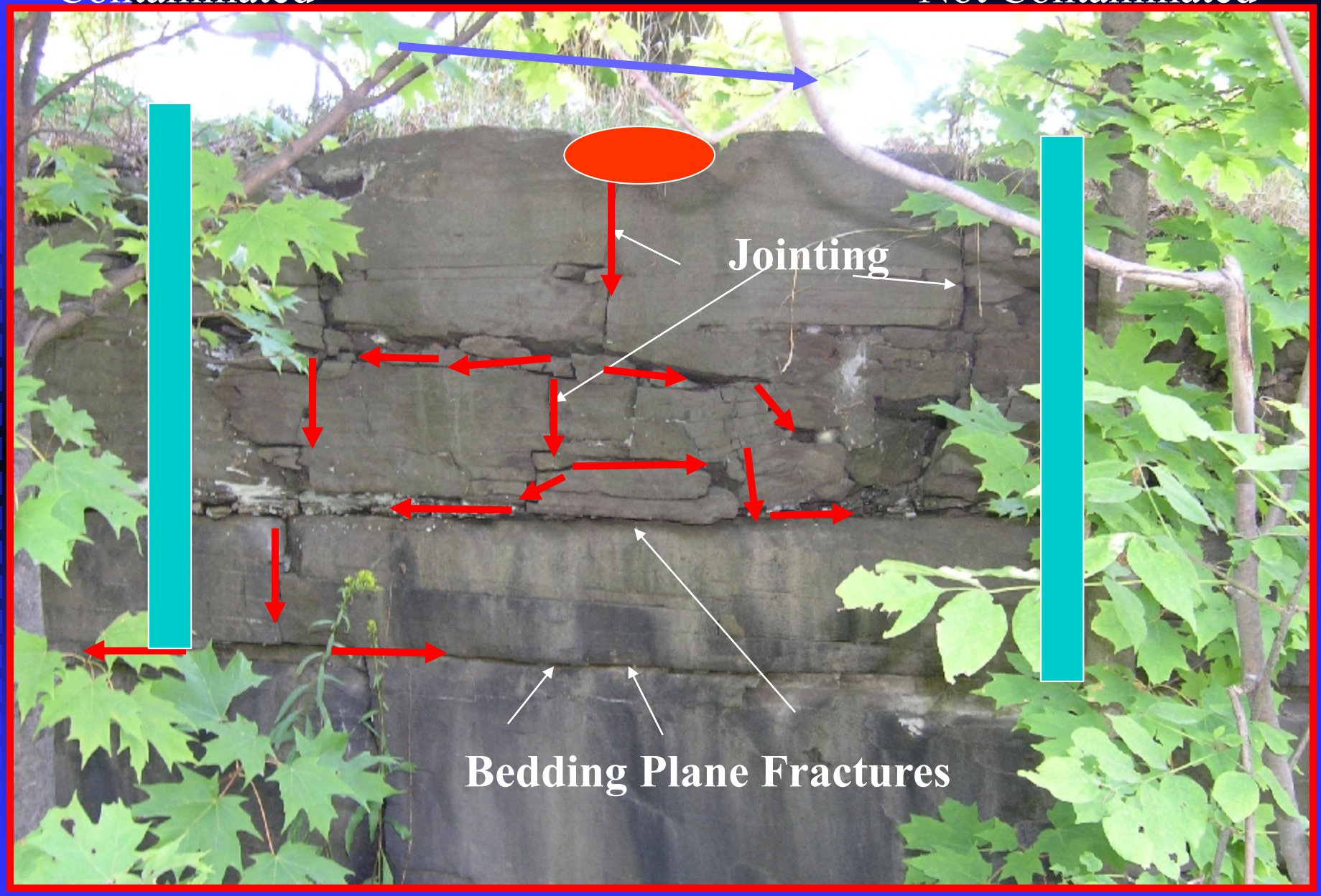
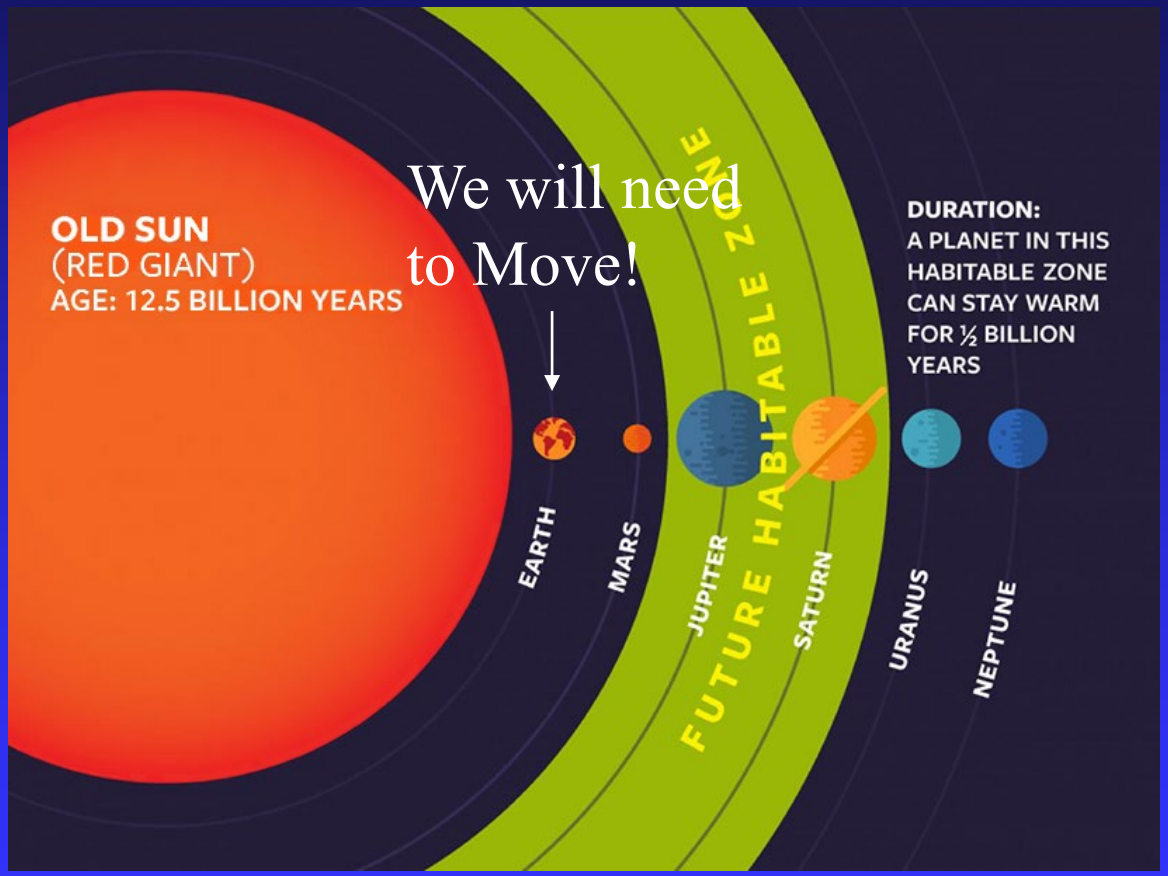
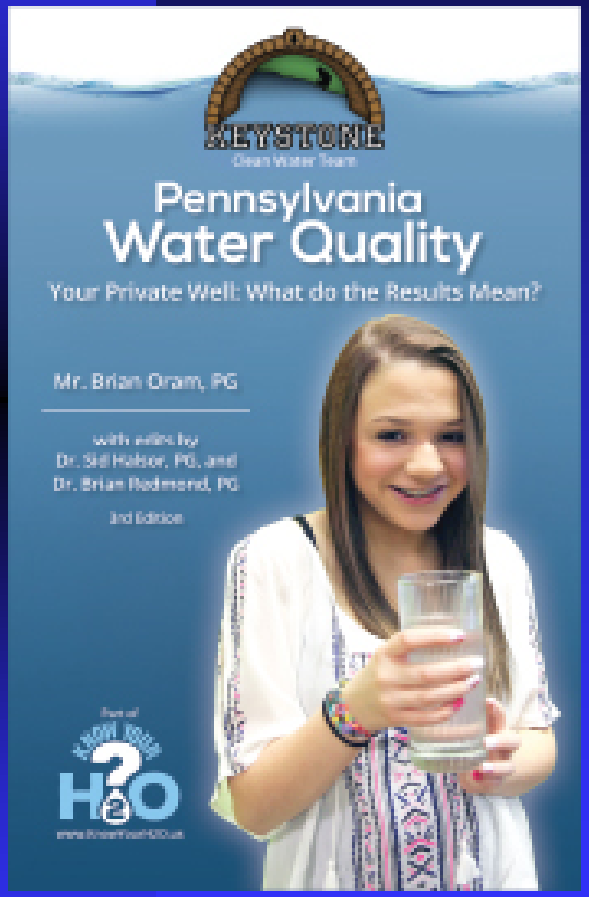


Photo by: Mr. Brian Oram (2004)

The End !


We will need
to Move!
OLD SUN
(RED GIANT)
AGE: 12.5 BILLION YEARS
FUTURE HABITABLE ZONE
DURATION:
A PLANET IN THIS
HABITABLE ZONE
CAN STAY WARM
FOR ½ BILLION
YEARS
EARTH
MARS
JUPITER
SATURN
URANUS
NEPTUNE

Our Latest Educational Resource



KEYSTONE
Clean Water Team

Description of the following:

a. Citizen Database
b. Baseline Testing
c. Drinking Water Standards
d. Specific Water Quality Standards
e. Treatment Options
f. How to Shock Disinfect a Well
g. How to Properly Construct a Well
h. General Guidelines on Baseline Testing Parameters.

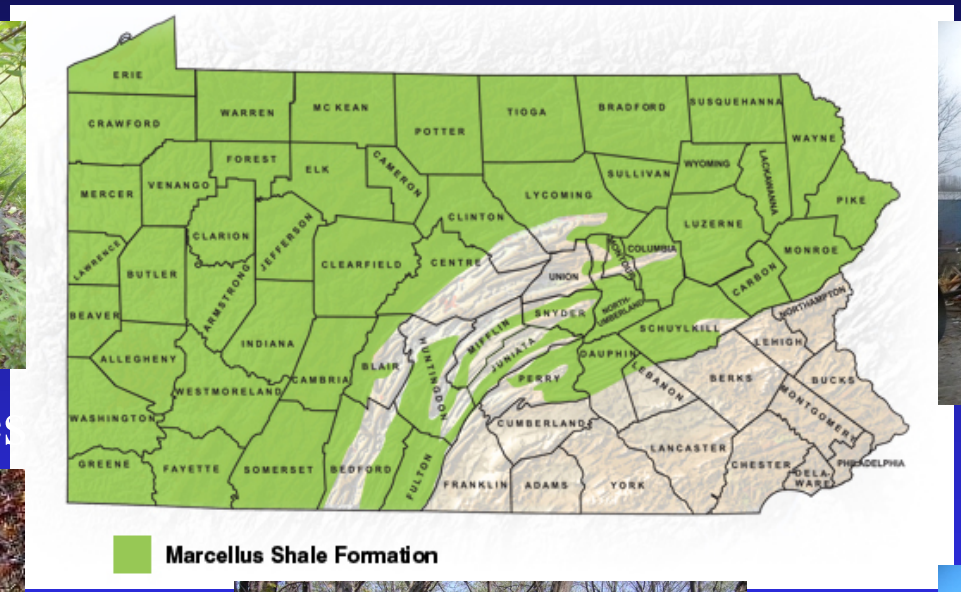
And More. **Cost $ 10.00**

Other Resources at http://www.water-research.net

Supports a Local 501C3 – Carbonwaters.org

Pennsylvania Groundwater / Geology
Working Together as a Community

Water Resources



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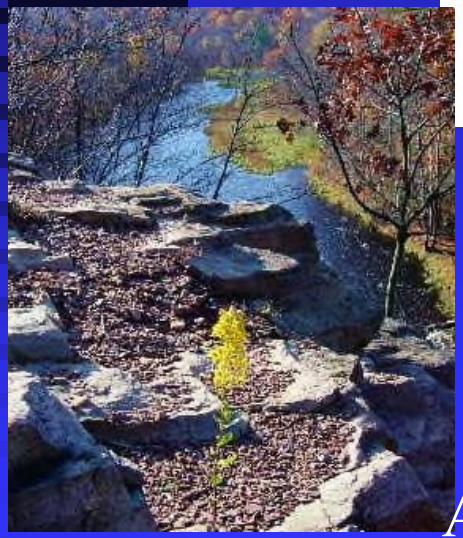

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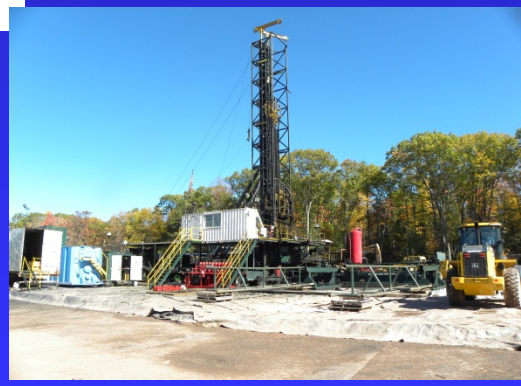

New Issues