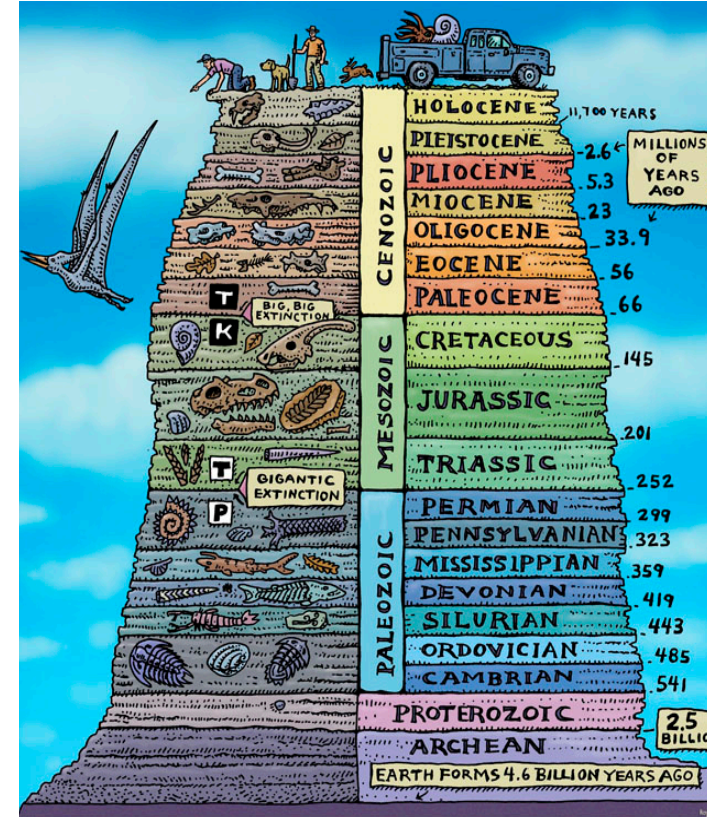




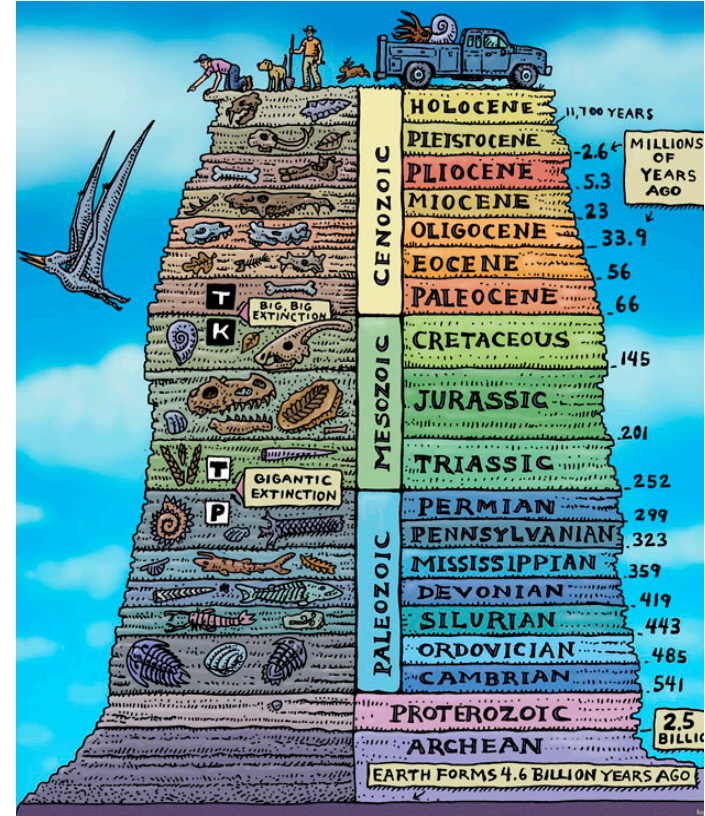
Geologic Time Scale





Essential Questions:

1. How does the relative and absolute age of rocks and the fossil record provide evidence to Earth's geologic history?
2. How is Earth's geologic history classified?
3. What are some major events in the Earth's geologic history?



Geologic Time Scale



Earth Scientists

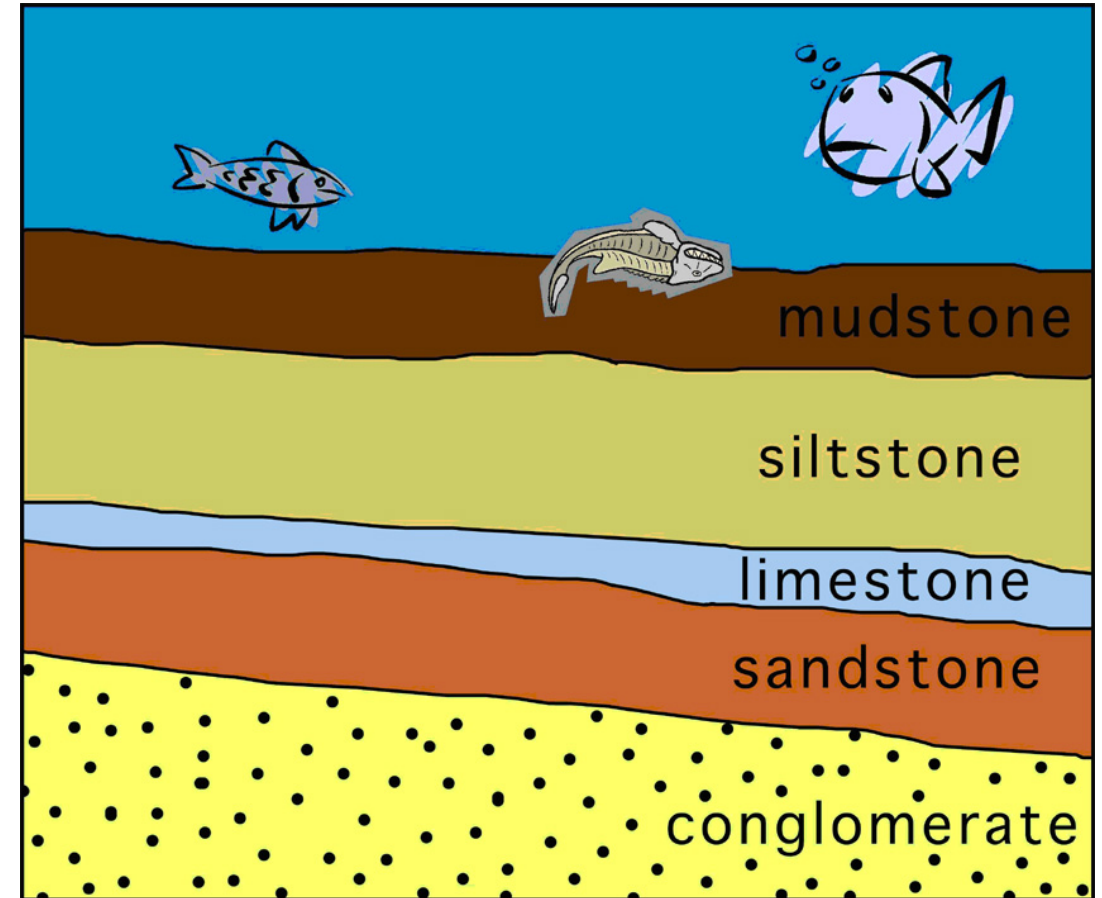
- Geologist – a scientist who studies the Earth's crust as well as the processes and history that shaped it
- Paleontologist – a scientist that studies fossil remains found on the Earth's surface in order to study primitive life forms such as: plants, animals, fungi, and bacteria

Geologic Time Scale

Stratigraphy

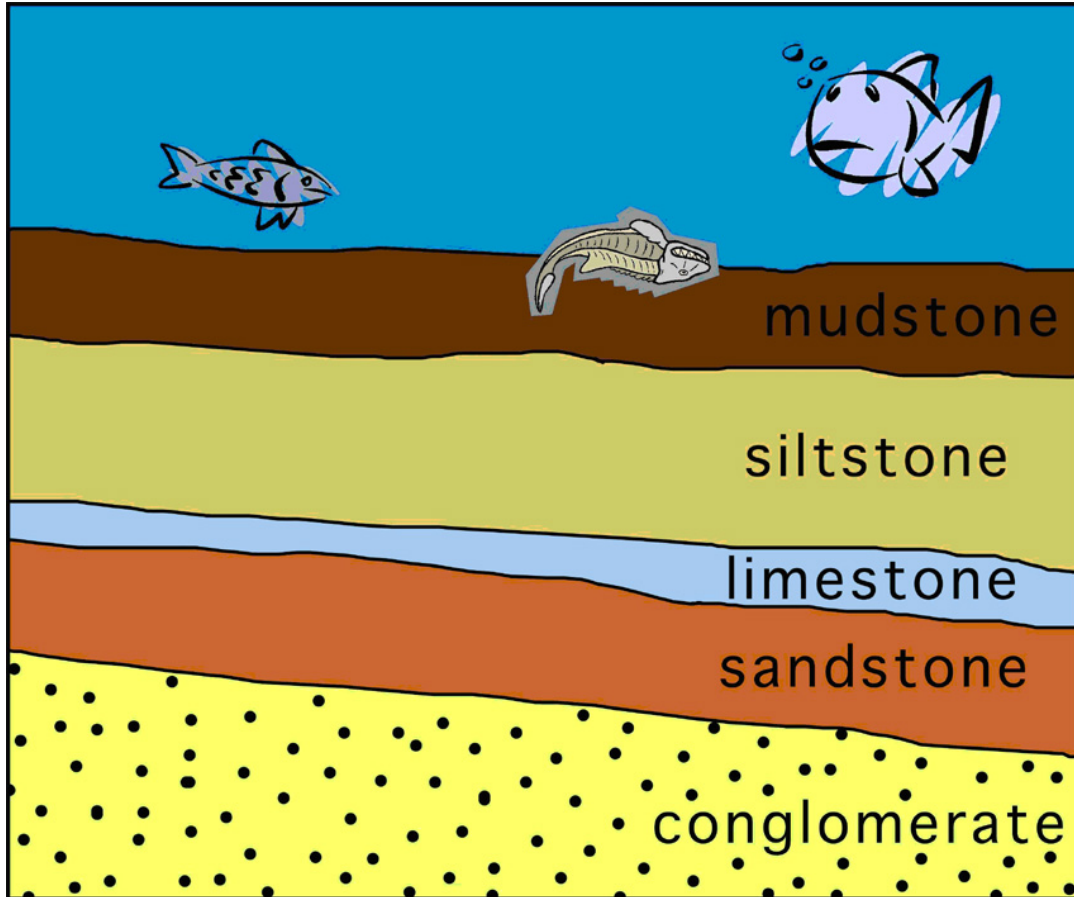
- A branch of geology dealing with the arrangement of sedimentary rock layers or strata
- Geologists assume the newest rock layers are on top of the older ones, unless some type of disturbance occurs.
- Called the **Law of Superposition**

Sedimentary Rock Layers



Geologic Time Scale

Sedimentary Rock Layers



Relative Age

- The strata of sedimentary rocks is important in determining their relative age.
- Relative age determines the “relative” order of past events but not the absolute age.
- Like saying you’re relatively younger than your grandfather.

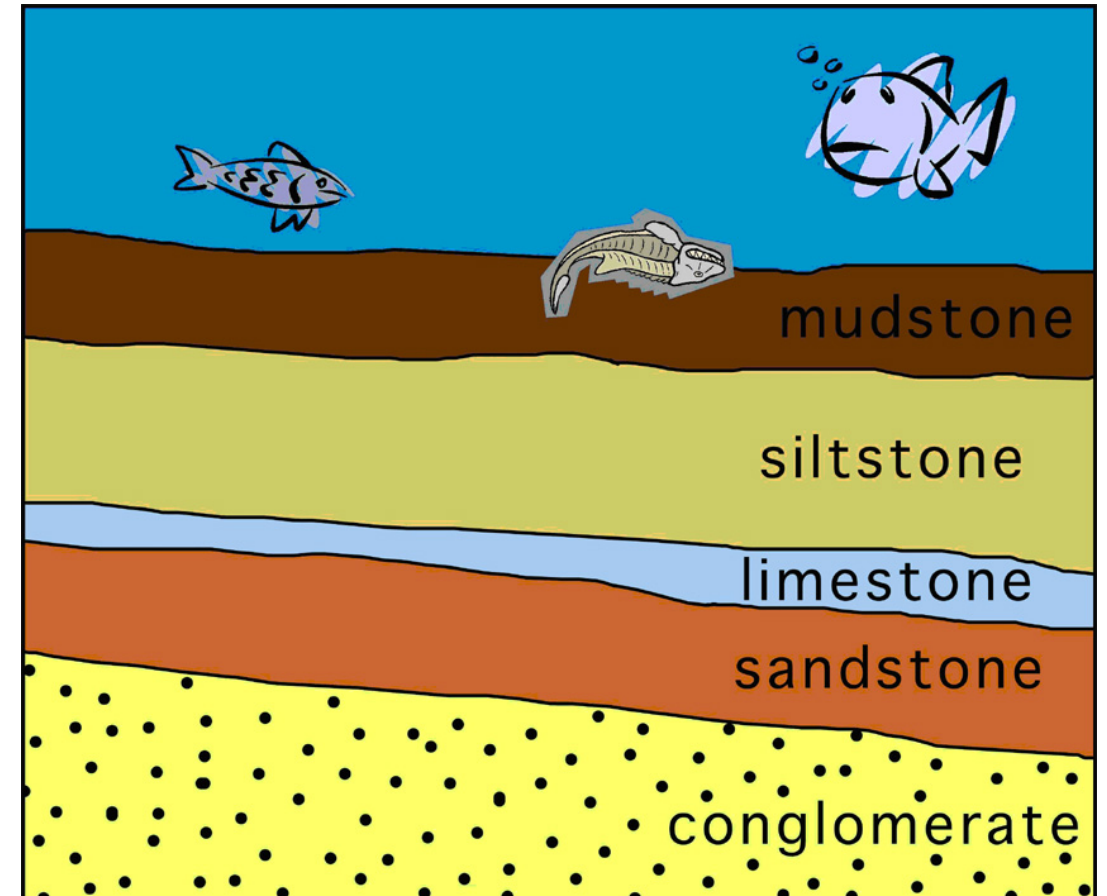


Quick Action – Geologic Time Scale

Determining Relative Age

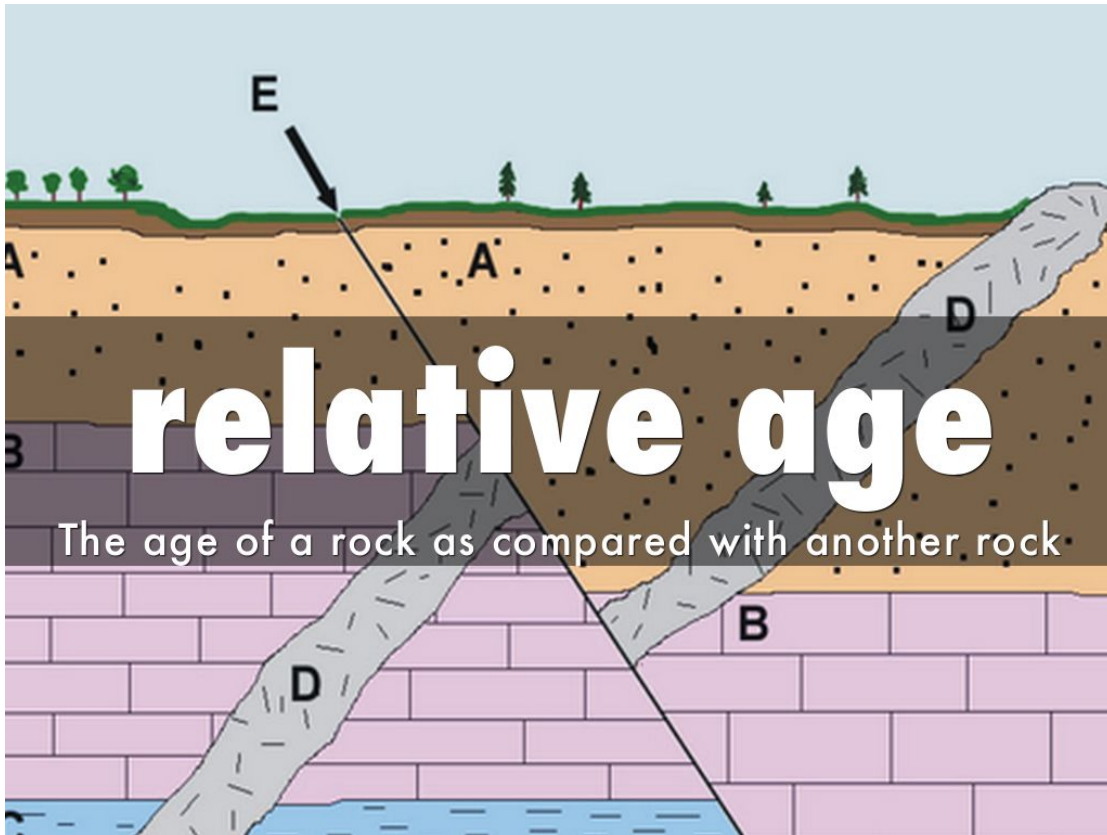
1. Which is older sandstone or limestone?
2. Which is older mudstone or siltstone?
3. Which is the youngest rock in this strata?
4. Which is the oldest rock in this strata?

Sedimentary Rock Layers



Geologic Time Scale

Sedimentary Rock Layers



Relative Age

- Strata is sometimes disturbed.
- Here we see a fault (E) and an igneous intrusion (D)
- See if you can determine the order of the strata in this diagram.
- Determining relative age in the field is sometimes very difficult because of these disturbances.

Geologic Time Scale

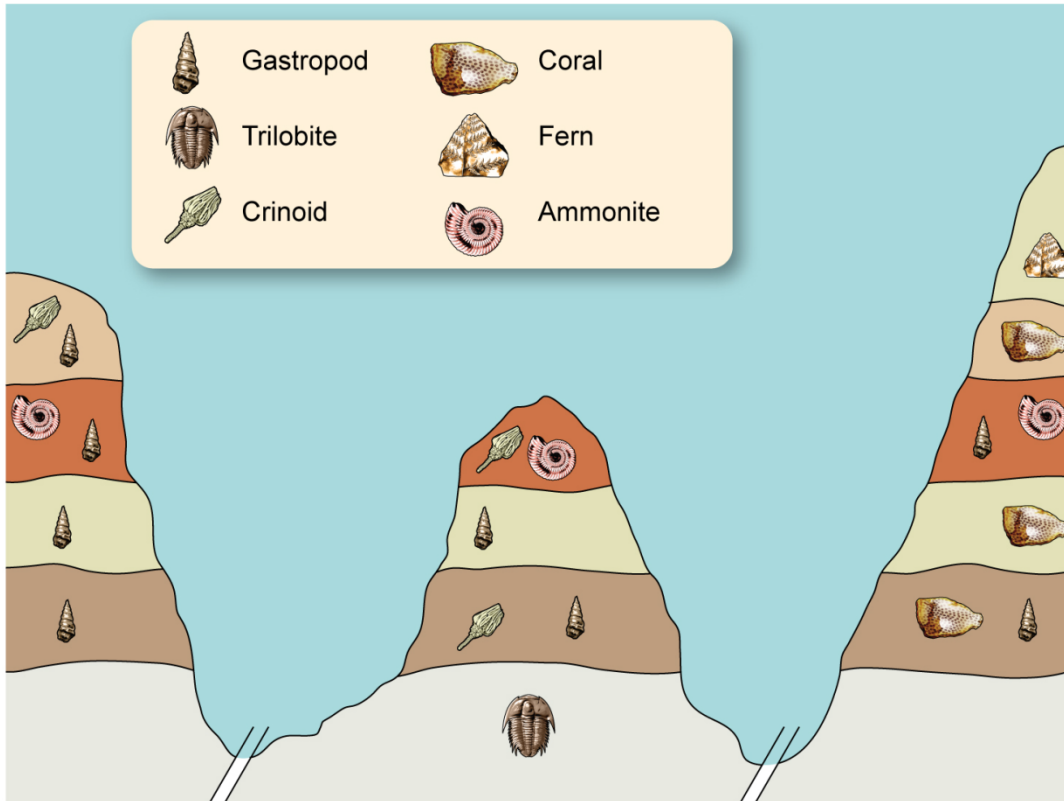
Fossils

- Preserved remains or traces of animals, plants, and other organisms from the remote past
- Fossil Record – History of life as documented by all fossils, preserved in sedimentary rock strata
- Provides a snapshot of past events in Earth's geological history



Geologic Time Scale

Which organism would make a good index fossil?



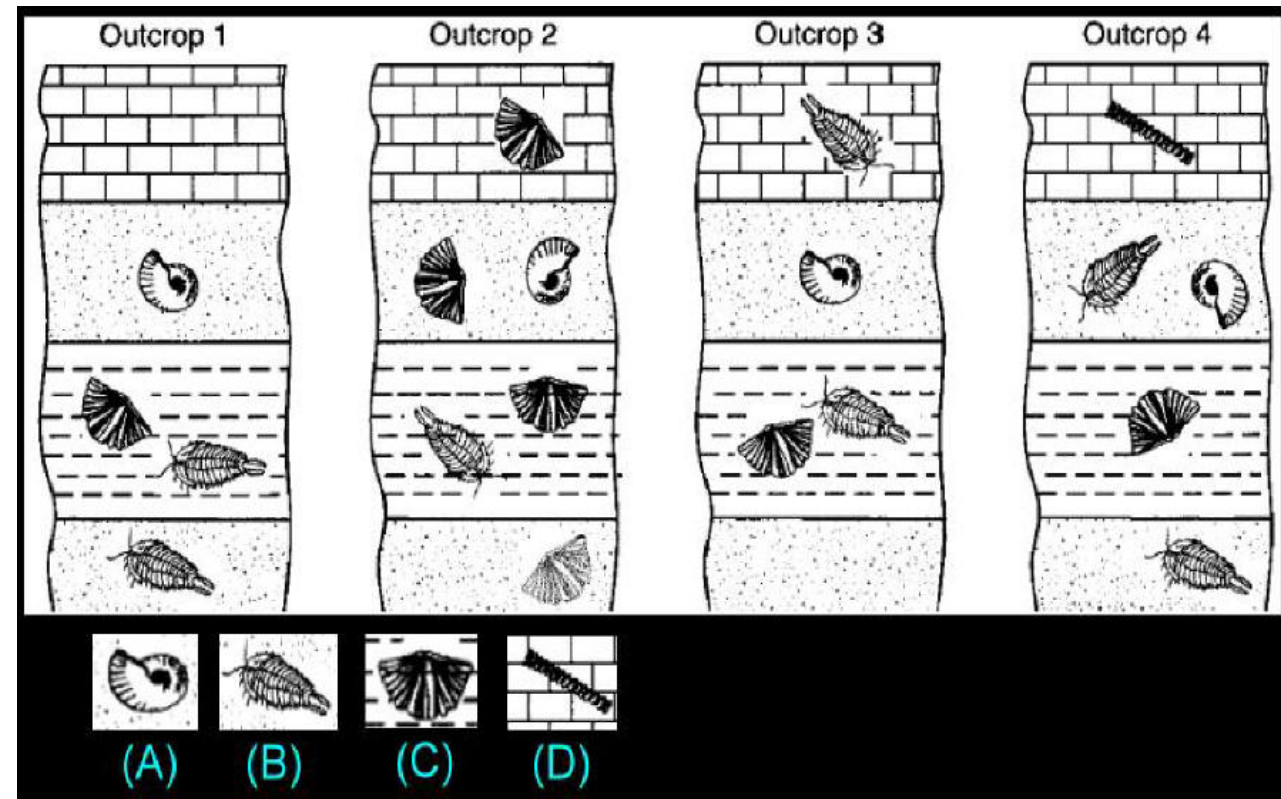
Index Fossils

- Special fossils called “index fossils” indicate to geologists the boundaries in geological time.
- This is another tool to determine the age of rocks.
- Characteristics of Index Fossils
 - Easily recognizable
 - Abundant
 - Wide geographic distribution
 - Live a short time

Geologic Time Scale

Fossil Record and Rock Strata

- Index fossils are used to correlate the age of the rock strata
- If two different rock strata in different areas on Earth contain the same index fossils, then the strata are probably the same age.



Which organism would make the best index fossil?



Quick Action – Geologic Time Scale

You know about the **Law of Superposition** and that the youngest rocks are found on top of older rock unless something has disturbed the rocks. This helps geologists determine the relative age of rocks.

Now draw a picture of fossils and their corresponding rock layers in three different locations. Choose one fossil to represent an index fossil. This is another tool geologists use to determine the age of sedimentary rock strata.



You can create your own images for fossils.

Exchange drawings with a classmate, and see if they can find your index fossil.

Geologic Time Scale



Radioactive Dating Examples

Element	Half-life
Carbon-14	5,730 years
Uranium-238	4.5 Billion years
Potassium-40	1.3 Billion years
Sodium-24	15 hours
Iodine-131	8 days

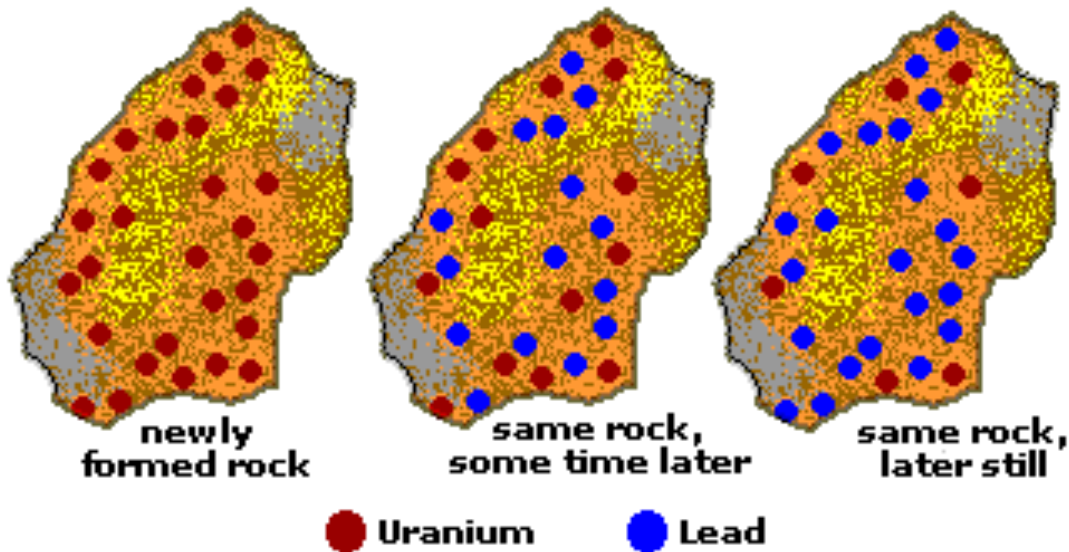
Absolute Age

- Most accurate form of dating, also call radiometric dating.
- Uses the decay of radioactive elements to find the absolute age of a rock or fossil
- This relies on the property of half life, which is the predictable time an element takes to decay.

Geologic Time Scale

This shows how uranium breaks down into lead. The time it takes to do this is predictable.

Radioactive Age Dating of Rocks



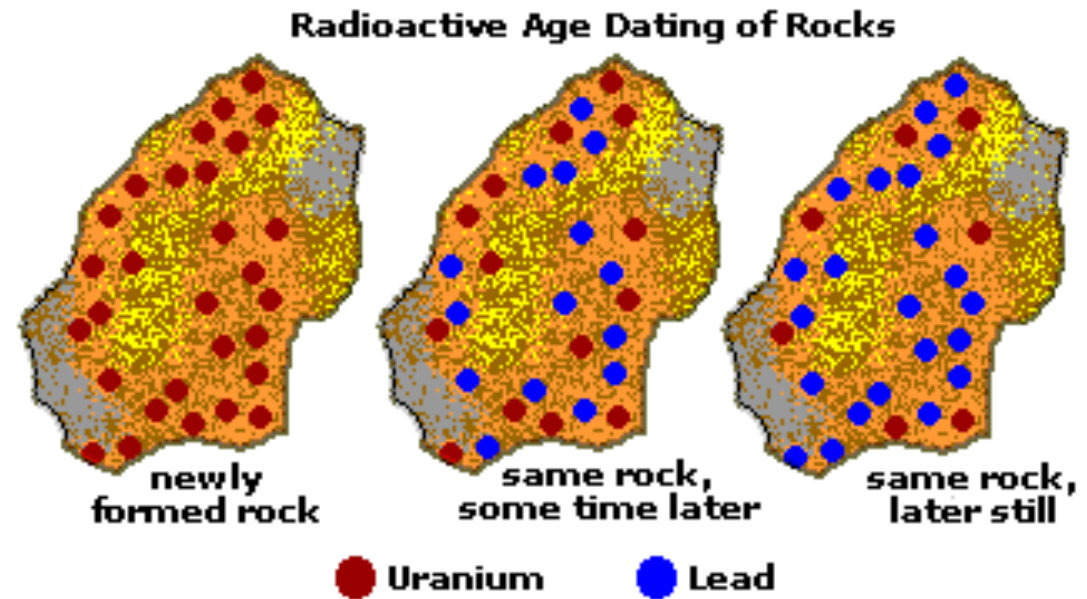
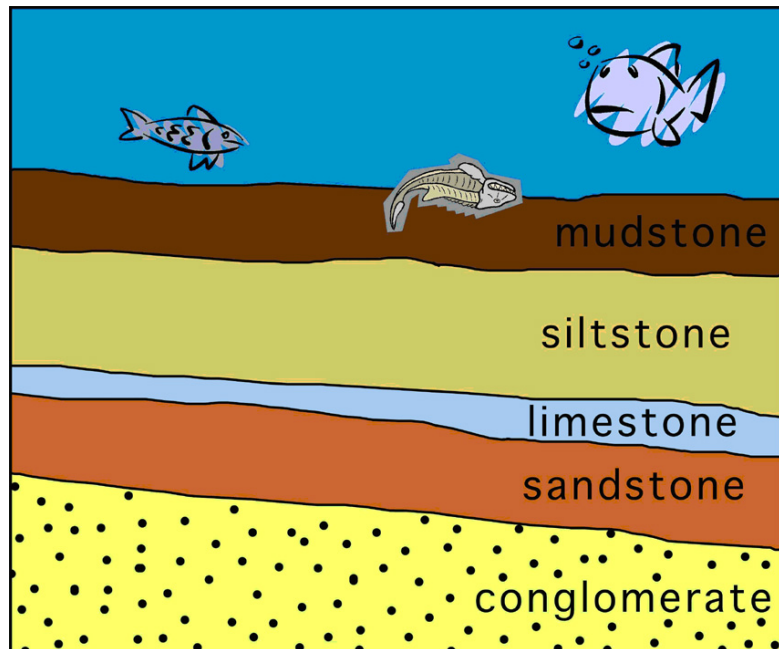
Absolute Age

- Geologists tend to mix and match relative age and absolute age dates to piece together a geologic history.
- Like saying you are 12 years old and your grandfather is 72 (absolute) instead of you are younger than your grandfather (relative).



Quick Action – Geologic Time Scale

With a partner discuss your understanding of relative age vs. absolute age.



Geologic Time Scale

Geologic Time Scale

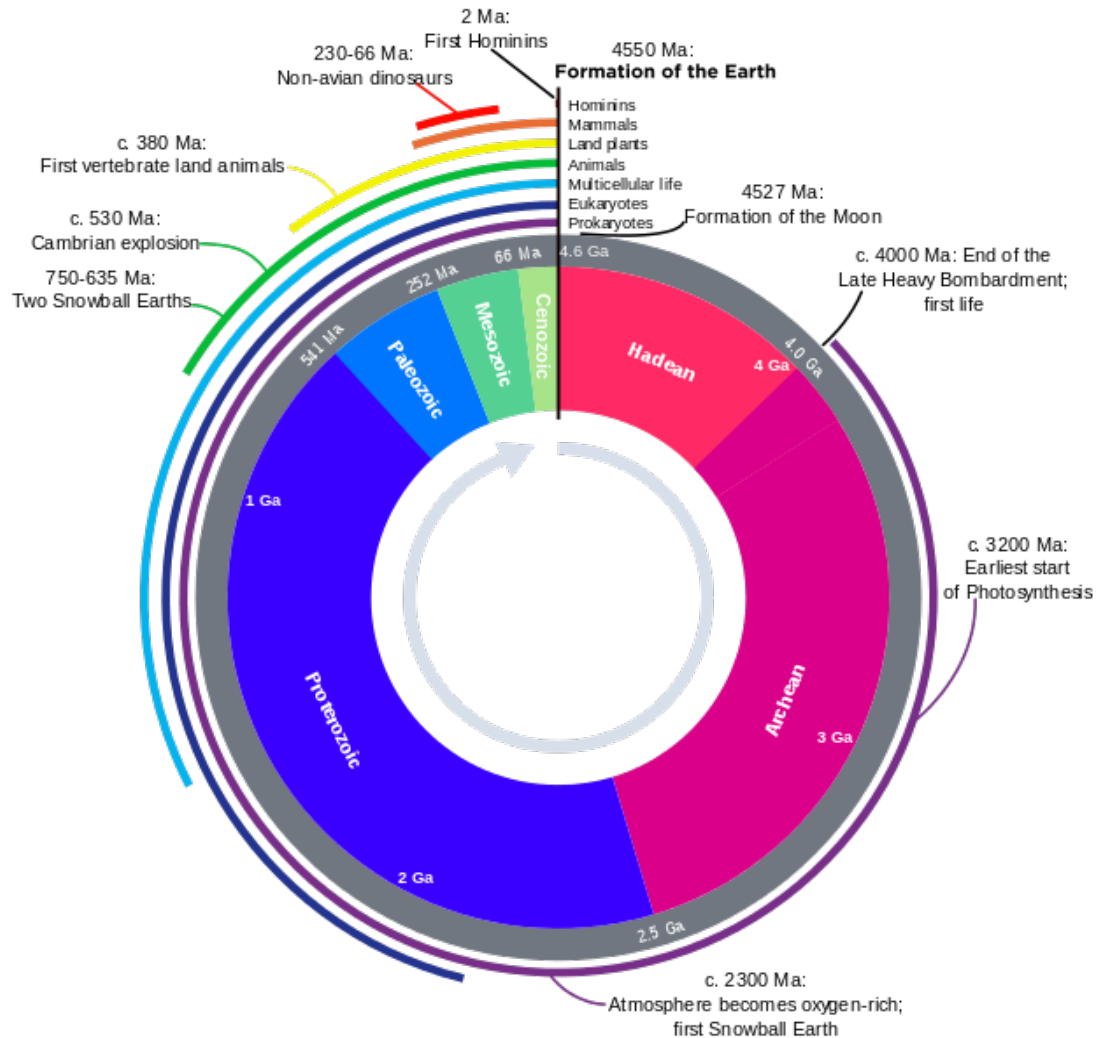
- All of Earth's geological history represented on a chronological time chart
- Based on rock strata and the fossil record
- Broken into different time chunks, the largest being the Eon, then Era, Period, and Epoch.
- m.y. stands for millions of years. This diagram is not to scale.

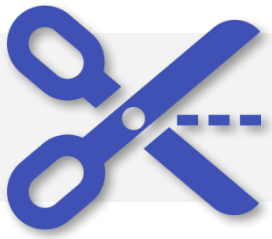
Eon	Era	Period		Epoch	m.y.	
Phanerozoic	Cenozoic	Quaternary		Holocene	1.5	
				Pleistocene		
		Neogene		Pliocene	23	
				Miocene		
		Paleogene		Oligocene	65	
				Eocene		
				Paleocene		
	Mesozoic	Cretaceous			250	
		Jurassic				
		Triassic				
	Paleozoic	Permian			540	
		Carboniferous	Pennsylvanian			
			Mississippian			
			Devonian			
		Silurian				
		Ordovician				
		Cambrian				
		Precambrian				Proterozoic
	Archean			3800		
Hadean				4600		

Geologic Time Scale

Geologic Time Scale

- Look how much of the Earth's geologic history falls into Hadean, Archean, and Proterozoic (together called Precambrian) - 88%
- If this were a clock, humans show up 11:58:43pm.
- Notice some of the important events which happened over 4.6 b.y.

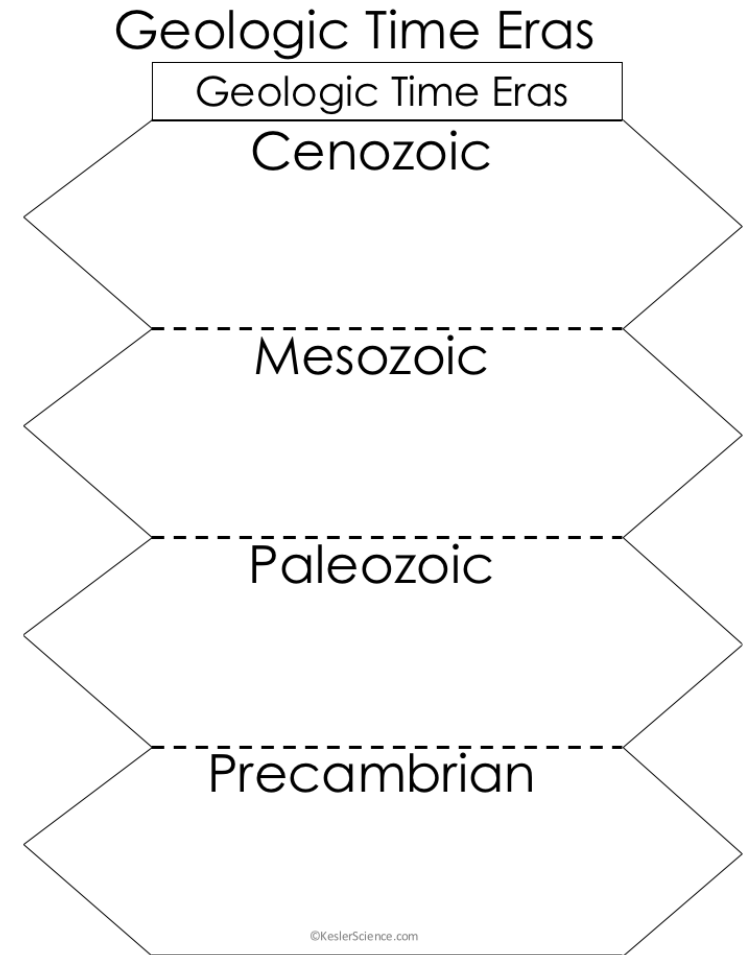




Quick Action – INB Template

Geologic Time Scale INB Template

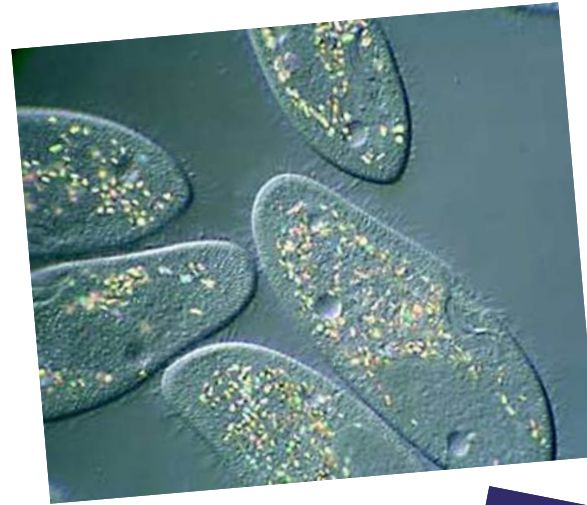
1. Cut out the template along the solid lines.
2. Fold dotted tabs and glue into notebook along the skinny tab.
3. Use your teacher's INB as a guide.



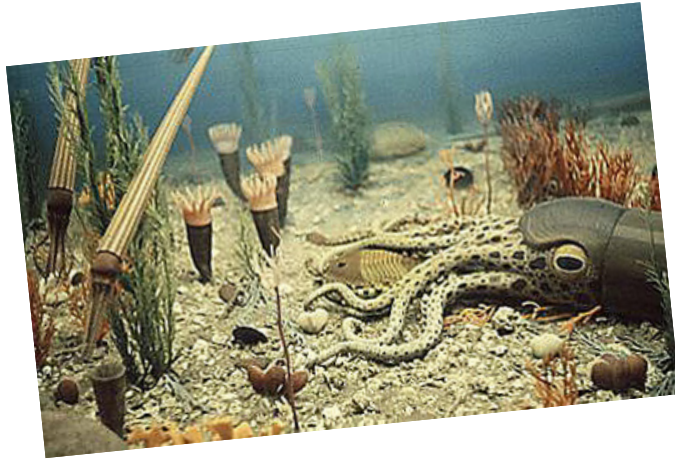
Geologic Time Scale

Precambrian

- Broken into 3 parts Hadean, Archean, and Proterozoic
- Marks the beginning of Earth approximately 4.6 b.y.
- Oldest rock fragment on Earth contains a mineral, zircon, that is 4.4 m.y.(found in Australia)
- Very primitive life forms: one-celled animals, bacteria, jellyfish



Geologic Time Scale



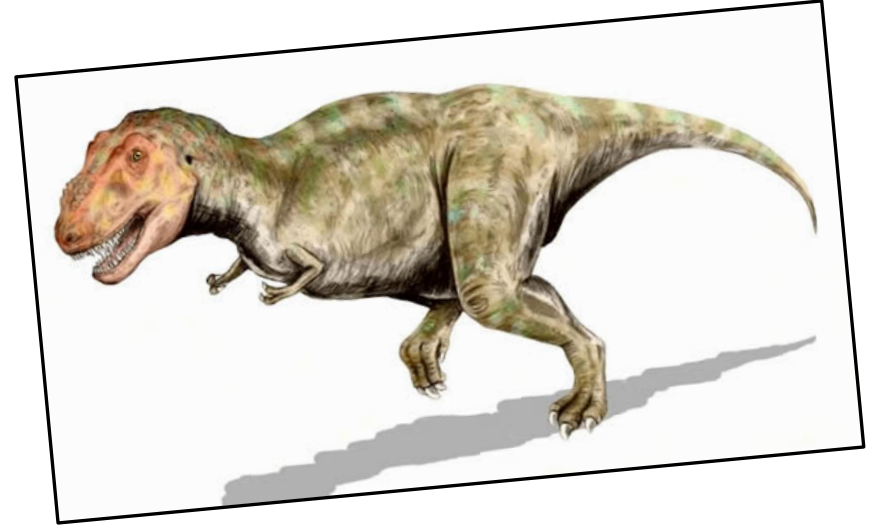
Paleozoic Era (early life)

- Marks the formation of the super continent, Pangaea
- Life developed rapidly
 - Marine plants and invertebrates
 - Fish and ferns
 - Amphibians
- Mass extinction at the end of Paleozoic

Geologic Time Scale

Mesozoic Era (middle life)

- Increased complex life forms including:
 - Dinosaurs
 - Small mammals
 - Birds
 - Conifers and flowering plants
- Rocks in the Petrified Forest in AZ were deposited during this time.
- Another mass extinction at end of Mesozoic.



Geologic Time Scale



Cenozoic Era (late life)

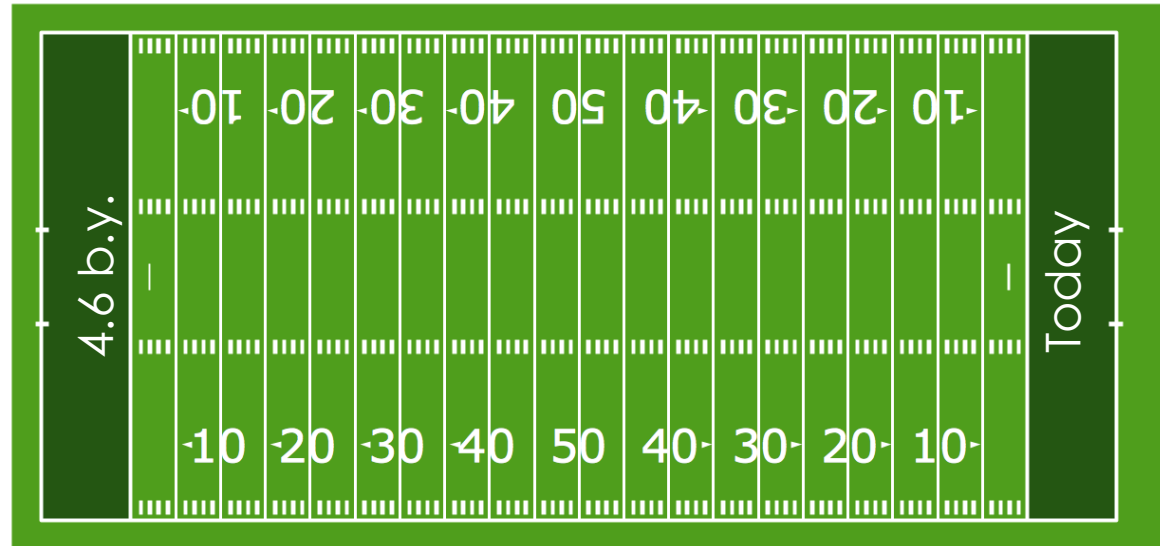
- Currently in this Era
- Development of:
 - Large mammals
 - Human beings
- Periods of ice ages played a role in the formation of the geological features visible on Earth today.



Quick Action – Geologic Time Scale

Draw a football field on a piece of paper. At one end write 4.6 b.y. and the other write Today.

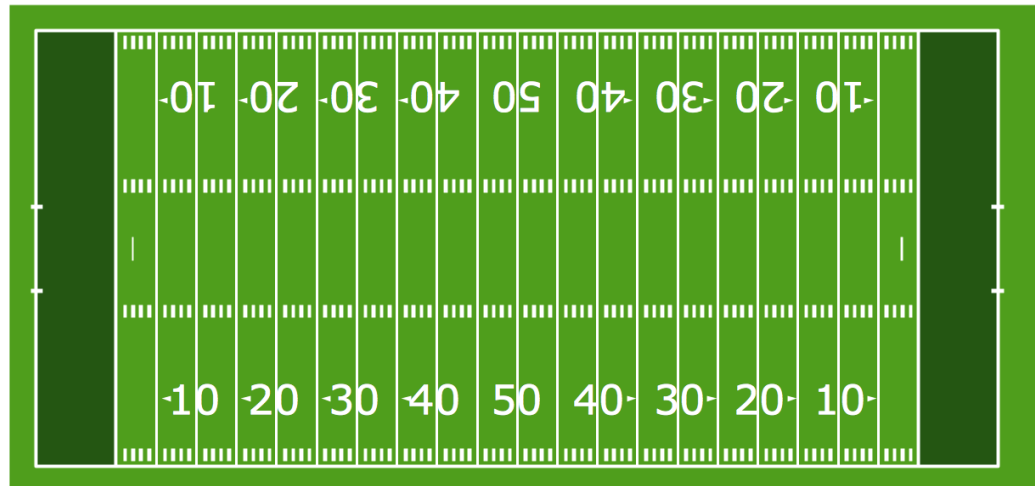
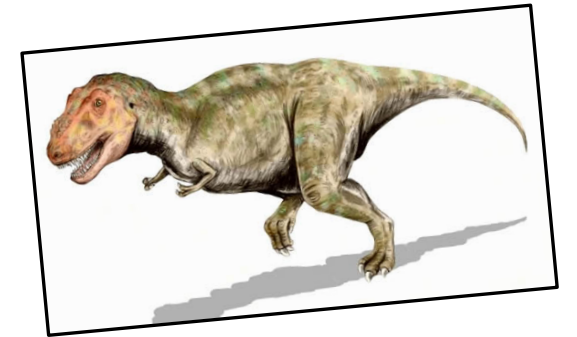
At which yard line do you think each of the eras begin – Precambrian, Paleozoic, Mesozoic, and Cenozoic. Mark it on your field.



Geologic Time Scale

Answers

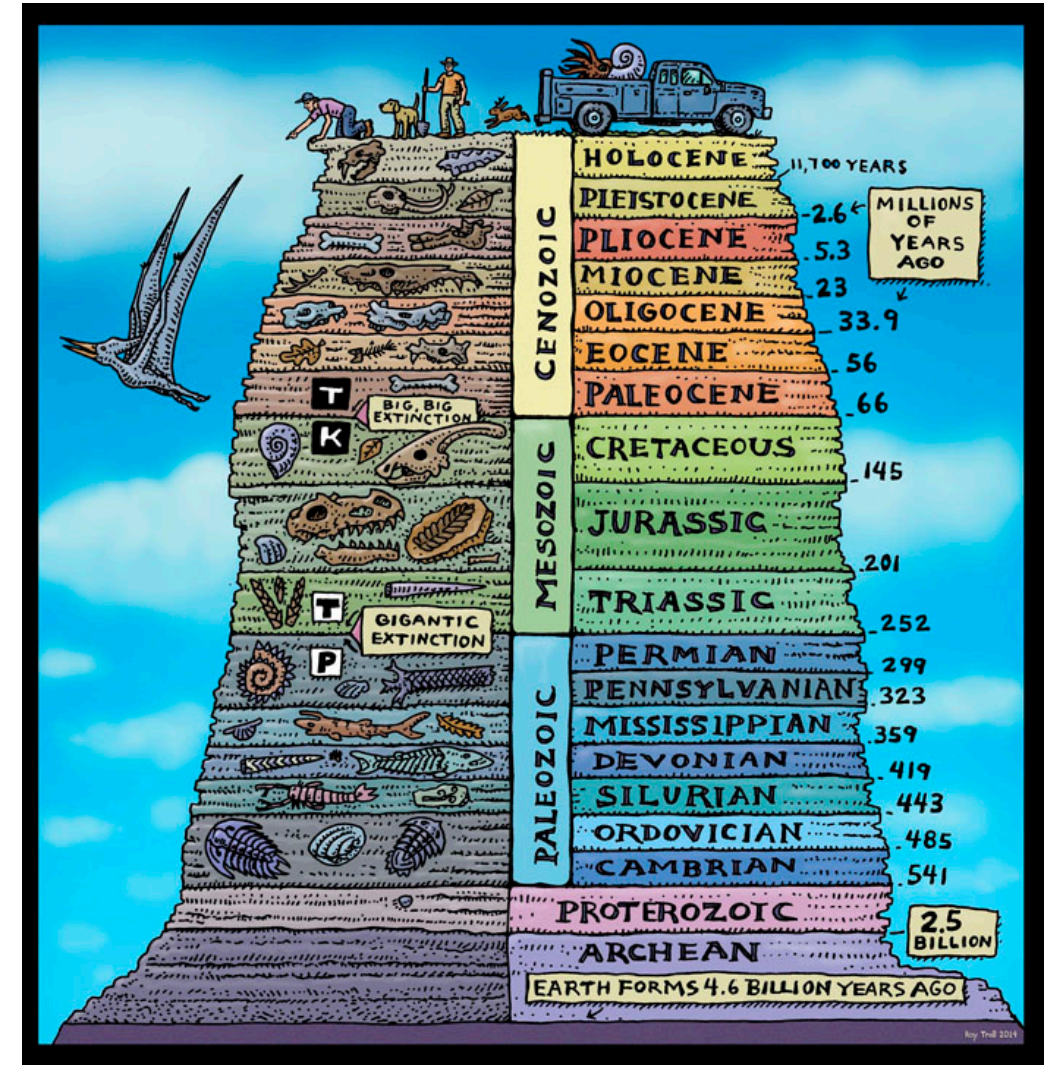
- Precambrian Time (0-87 yards)
- Paleozoic Era (87-95 yards)
- Mesozoic Era (95-98.5 yards)
- Cenozoic Era (98.5-100 yards)



Geologic Time Scale

Living Organisms

- Fossils of previous living organisms are used to further divide Earth's geologic history.
- Life on Earth has changed over time or evolved quite a lot in 4.6 b.y.
- We live in the Cenozoic Era which is further broken down into Epochs.
- In which Epoch do we live?



Geologic Time Scale

Geologic Time Scale

- During the Earth's 4.6 billion years, it has suffered 5 major mass extinctions.
- An extinction is the end of a group of organisms, usually a species.

The 5 major mass extinctions:



mya = million years ago

Eon	Era	Period	Epoch	m.y.
Phanerozoic	Cenozoic	Quaternary	Holocene	1.5
			Pleistocene	
		Neogene	Pliocene	23
			Miocene	
		Paleogene	Oligocene	
			Eocene	
	Mesozoic	Cretaceous	Paleocene	65
				250
	Paleozoic	Permian		540
		Carboniferous	Pennsylvanian	
			Mississippian	
		Devonian		
		Silurian		
		Ordovician		
		Cambrian		
Precambrian	Proterozoic			2500
	Archean			3800
	Hadean			4600

Geologic Time Scale



Dinosaur Extinction

- Most recent extinction is called the Cretaceous-Tertiary extinction event.
- Happened 65.5 m.y. ago
- Climate and geologic changes are thought to have weakened the dinosaurs.
- A meteor strike was probably the final blow.



Check for Understanding

Can you...

1. Explain how the relative and absolute age of rocks and the fossil record provide evidence of Earth's geological history?
2. Interpret the geological time scale?
3. Describe some major events in Earth's geological history?