

GEOLOGIC TIME SCALE ANALOGY

PURPOSE: To show students the order of events and time periods in geologic time and the order of events and ages of the physiographic provinces in Virginia.

BACKGROUND:

Exact dates for events change as scientists explore geologic time. Dates vary from resource to resource and may not be the same as the dates that appear in your text book.

Analogies for geologic time: a 24 hour clock or a yearly calendar. Have students or groups of students come up with their own original analogy.

Before you assign this activity, you may want to try it, depending on the age of the student, level of the class, or time constraints, you may want to leave out the events that have a date of less than 1 million years.

! Review conversions in the metric system before you begin this activity !

References

L.S. Fichter, 1991 (1997) <http://csmres.jmu.edu/geollab/vageol/vahist/images/Vahistry.PDF>
<http://pubs.usgs.gov/gip/geotime/age.html>

Wicander, Reed. *Historical Geology*. Fourth Edition. Toronto, Ontario: Brooks/Cole, 2004. Print.

VIRGINIA STANDARDS OF LEARNING

ES.10 The student will investigate and understand that many aspects of the history and evolution of the Earth can be inferred by studying rocks and fossils. Key concepts include: relative and absolute dating; rocks and fossils from many different geologic periods and epochs are found in Virginia.

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Building a Geologic Time Scale

Time:

Materials Meter stick, 5 cm adding machine tape, pencil, colored pencils

Procedure

1. For this activity, the scale is
 - 1 mm = 1 million years
 - 1 cm = 10 million years
 - 1 m = 1 billion years
2. Stretch out the adding-machine tape. Use the meterstick to draw a continuous line down the middle of the tape length wise. This line is your time line. Draw a straight line across the right end of your tape. Label this line "**Present Day**".
3. From the line labeled "Present Day", measure exactly 1 meter and draw a line across your time line. Label this line "**1 Billion before present**" or '**1 bp**'.

Draw four more lines across the center line on the tape, exactly 1 m apart. Label these lines "**2 billion before present**", "**3 billion before present**" and so on until you reach "**5 billion before present**". Use these lines as reference points as you plot the events listed below on your tape.

To help you get started, directions for plotting the first event are below:

- a. Measure 600 mm (or 60 cm) from the line labeled "4 billion before present". This should be between the 4 by bp and the 5 by bp lines. Mark that spot with a line across the center line. Label this line "**4.6 billion before present**", and write "**Earth's Beginning**".
 - b. For the second event, which is 3900 million (or 3.9 billion), measure 100 mm or 10 cm from the line labeled "4 billion before present" and mark that spot. This should be between 4 by bp and 3 by bp. (closer to 4 by bp). Label this line "**Oldest dated crustal rocks**".
4. Plot each event in the table on the tape. Label both the number of years ago and the event.
 5. Shade the line where the Paleozoic is represented **blue**, shade the line where the Mesozoic is represented **green**, and shade the line where the Cenozoic is represented **yellow**.
 6. Color each event below that has an asterisk (*) next to it **purple**. These are the major geologic events that formed the landscape that we now enjoy in Virginia.

GEOLOGIC TIME AND EVENTS

Millions of Years Ago	Event
4600	Origin of the Earth/Precambrian Era
~3900	Oldest Dated Crustal Rocks (Canada and Western Greenland)
3800	Oldest Evidence for Life
2000	First Oxygen in Atmosphere
1000	<u>Compression and Volcanism formed the Blue Ridge Mountains*</u>
* 540	Beginning of the Paleozoic Era / Cambrian Period
530	Extensive Shallow Seas/Appalachians began to form
500	<u>Age of sedimentary rocks found in the Valley and Ridge Province of Virginia*</u>
* 490	Oldest Fish Fossils / Beginning of the Ordovician Period
465	First Vertebrates
* 442	First land plants / Beginning of the Silurian Period
* 435	<u>Taconic Orogeny dates from 400 – 500 mybp (this occurred when Africa was approaching North America and was a time of intrusions of magma and volcanic activity that formed many of the rocks of the Piedmont) *</u>
* 415	Beginning of the Devonian Period
375	Oldest Amphibian Fossil
* 355	First Crinoids/Beginning of the Mississippian Period
*330	<u>Age of Petersburg Granite— This is when the magma that created this rock began to cool off and crystallized deep below the Earth's surface, according to dates given for the Petersburg Granite this event continued for about 15 million years.... (This is the age of the bedrock under the James River at the Fall Zone) *</u>
*320	First cockroaches & horsetails / Beginning of the Pennsylvanian Period
*300	<u>Alleghanian Orogeny begins—building of Appalachian Mountains starts (250 – 300 mybp). *</u>
*290	Beginning of the Permian Period
280	First Reptiles
246	<u>Appalachian Mountains are at their highest -- Pangaea is one continent</u>
*245	Beginning of the Mesozoic Era / Triassic Period

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- 225 Approximate age of Virginia's Triassic Sedimentary deposits such as the Midlothian coal. This was a time of tension as Pangaea began to split apart, Grabens formed and filled with sedimentary material and some fossils formed.*
- *206 Beginning of the Jurassic Period
- 200 First Mammals and Dinosaurs
- 160 First Birds
- 145 Atlantic Ocean opens up
- 144 Beginning of the Cretaceous Period
- 130 Oldest fossils of Flowering Plants
- 70 Erosion of much of Virginia and deposits of the Coastal Plain begin*
- * 66 Rocky Mountains begin to rise/Dinosaurs go extinct / Beginning of the Cenozoic Era / Tertiary Period
- 5 *Chesapecten jeffersonius* (state fossil) lived in the shallow seas that stretched from Hanover to the current Virginia Beach area*
- 3.4 Oldest *Australopithecus afarensis* fossils
- *1.6 - 2.0 Pleistocene Ice Age begins / Beginning of the Quaternary Period

TEACHERS: when students get to this point, it is beneficial to have them expand the last mm to an extra meter of adding machine tape. This is also a good refresher in metric conversions.

- 0.6 Oldest *Homo erectus*
- 0.1 *Homo sapiens*
- 0.005 Start of Modern Civilization
- 0.000055 Start of the Space Age (October 4, 1957)
- 0.0000__ Your birth (put your age as the last two digits)

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WHEN YOU FINISH YOUR TIME LINE, answer the following questions:

1. List the events that formed the major landscape regions of Virginia.

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____
- f. _____
- g. _____
- h. _____
- i. _____

2. List the regions of Virginia in order from the oldest to the youngest with the oldest on the bottom of the list.

- a. _____ (youngest)
- b. _____
- c. _____
- d. _____
- e. _____ (oldest)

SCIENCE IN THE PARK: GEOLOGY

3. The dates that are on this geologic time scale do not necessarily match the dates in your text book. Why do you think this is true?
4. Which era is the longest?
5. Which era is the shortest?
6. In which era did dinosaurs exist or begin to exist?
7. In which era did mammals exist or begin to exist?
8. Which lived on the Earth the longer time, dinosaurs or mammals?
9. How many years does 1 cm represent in this scale?
10. Did you have difficulty plotting any of the events on the list? If so, why?