

## **Lesson Plan- What is the Geologic Time Scale?**

### **BIG IDEA:**

Earth is 4.6 billion years old

**2.6** – Life on Earth began more than 3.5 billion years ago

**2.7** – Over Earth’s vast history, both gradual and catastrophic processes have produced enormous changes.

### **MISCONCEPTIONS:**

Humans and dinosaurs existed on the Earth at the same time.

The plants and animals on Earth now, have always been on Earth.

The Earth is too big to change.

### **EARTH SCIENCE STANDARDS:**

E.ST.M.4 Geologic Time- Earth processes seen today (erosion, mountain building, and glacier movement) make possible the measurement of geologic time through methods such as observing rock sequences and using fossils to correlate the sequences at various locations.

E.ST.06.42 Describe how fossils provide important evidence of how life and environmental conditions have changed.

### **OTHER SCIENCE STANDARDS:**

S.IP.06.15 Construct charts and graphs from data and observations.

S.RS.06.12 Describe limitations in personal and scientific knowledge.

S.IA.06.11 Analyze information from data tables and graphs to answer scientific questions.

**GRADE LEVEL:** 6 – middle school

**TIME PERIOD:** 1 50- minute class period, with a brief reflection the next class period

PREP: Prior to the lesson, students need to know their birth date and time of birth. Have students write this information on a 2" X 2" card along with their name or initials. (I do this with my students at the beginning of the year, and have a birthday graph on display in the classroom all year; this lesson is done toward the end of the school year, so I take the cards and put them in a timeline format along one wall in my room for this activity) If you make the birthday cards only for this activity, give yourself a few days for students to find out the time of their birth as well as include absent students, so that you have a card for everyone. I typically have 140 students, so I have a long timeline. If no students have a birthday on January 1<sup>st</sup> or December 31<sup>st</sup>, make cards for those dates.

**MATERIALS NEEDED:**

2x2 inch cards (can use card stock, index cards, or heavy weight paper). I selected this size because this is the size my pocket chart allows for my birthday graph, but you can use whatever size works best for you.

Labels for the different time periods: PreCambrian, Paleozoic, Mesozoic and Cenozoic

Event strips (depends on how many students you have in your class, you should have at least one 'event strip' for each student. The events will be different 'markers' in Earth's geologic past. Events can vary.

Geologic Time Scale key: <http://www.uky.edu/KGS/education/geologictimescale.pdf>

Student Worksheet

**OVERVIEW:**

This activity gives students a visual of the history of the Earth based on its fossil record. This helps students put into context the history of the Earth by looking at a time scale they can comprehend, a calendar year. Students will first predict when different events in Earth's history happened in relationship to each other. Through this students will see that humans have not been here long relatively speaking and that we certainly did not co-habitat with dinosaurs. By using the birthdates as the timeline, they can connect with some of the geological events of Earth's history by what occurred 'on or near their birth date or that of a friend's birth date'. Students should also identify that Eras begin/end with a major change on Earth.

## **NEW TERMS:**

**Era-** a large division of geologic time usually shorter than an eon **ex. Paleozoic, Mesozoic, Cenozoic**

**Pre Cambrian Time** –of or relating to the earliest part of Earth’s history.

## **DAY 1**

Directed Inquiry Stimuli (Bell Work question):

What do you know about Earth’s history? You know that glaciers at one time covered Michigan. What are two things you think happened in Earth’s history before these glaciers and two things that happened after these glaciers?

After students have had time to respond to the opening question, give students time to share their responses with the class.

Direct students attention to the birthday time line. Remind students that the Earth is 4.6 billion years old. This is a really big number, too big for most people to really imagine. Today we will look at the geologic history of the Earth as if it all happened in one calendar year. At this time give each student one of the event strips (read them as they are passed out) and ask them to put it along the timeline where they think it should go. If they think their event happened near the beginning of Earth’s history, then put it near the beginning of the year, if they think it is something that happened near the middle of Earth’s history, then they should put their strip around June and so on. My timeline fits along the top of a magnetic white board, so I use magnets for students to place their events, use whatever works best for your classroom situation.

Acknowledge that some of the events that were given out are things that the student may not be familiar with and they will be blindly guessing, but that is okay for this activity.

Note that there is not a card for every day of the year on the board, and some dates may have more than one card (more than one birthday on a given day)

After all the strips are in place, give anyone a chance to move theirs if they desire.

Once all of the strips are in place, reveal the correct placement, with students moving their strip to the correct location.

After all the strips are in place, comment on your observations, did students seem to put events in order in relationship to each other, but not in the correct part of the year?...what happened at the end of one era and the beginning of another...give students time to share their observations.

Have students complete the worksheet to check for understanding of main concepts of the lesson either as homework, or during class.

The next day for the Bell Work assignment:

Yesterday we made a timeline of the geologic time scale using the birthdates of the students in this class. How did this activity help you better understand the geologic time scale? What were flaws in making a time line in this way?

### **RESOURCES/REFERENCES:**

Stanley, Steven M. *Earth System History*. New York: W.H. Freeman and Company, 2005. Second Edition. Print

<http://www.geosociety.org/science/timescale/>

<http://www.uky.edu/KGS/education/geologictimescale.pdf>

## THE GEOLOGIC TIME SCALE

Table 1. The development of life through time.

Million years

before present Era, System, or Event

Relative to a calendar

year (date time)

### Precambrian

**4600 Earth formed from planetary nebula 1/1 0:00**

3900 Inferred origin of life (first cells) 2/25 13:02

3800 Oldest age-dated rocks on Earth 3/5 11:28

3600 Fossil algae and stromatolites (prokaryots) 3/21 8:20

3250 Fossil evidence of bacteria 4/18 2:52

2100 Fossil evidence of cells with a nucleus (eukaryots) 7/18 8:52

1500 First multi-celled organisms (seaweed and algae) 9/3 23:28

670 Oldest marine worms and jellyfish 11/8 20:05

600 Vendian period begins: Ediacarian fossils 11/14 9:23

### Paleozoic

**544 Cambrian system begins 11/18 20:02**

515 Burgess Shale animals, animals with a notochord 11/21 3:15

**505 Ordovician system begins 11/21 22:18**

505 First fish 11/21 22:18

470 First fossil evidence of land plants 11/24 16:57

**438 Silurian system begins 11/27 5:53**

430 First vascular land plants 11/27 21:07

414 Oldest lung fish fossils 11/29 3:36

**408 Devonian system begins 11/29 15:01**

408 Oldest fossil evidence of mosses 11/29 15:01

385 First insects (beetles), scorpions, and centipedes 12/1 10:49

380 First lobe-finned fish 12/1 20:20

375 First land animals (amphibians) 12/2 5:52

370 First sharks 12/2 15:23

365 First seed plants (ferns) 12/3 0:54

**360 Mississippian system begins 12/3 10:26**

330 First possible reptiles 12/5 19:33

**320 Pennsylvanian system (Kentucky coal) 12/6 14:36**

286 Permian system begins 12/9 7:21

260 Sail-backed reptiles (Dimetrodon) 12/11 8:52

245 End of Paleozoic, 96% of all life on Earth perishes 12/12 13:26

### Mesozoic, the "Age of Reptiles"

**245 Triassic system begins 12/12 13:26**

240 First crocodiles 12/12 22:57

228 First dinosaurs (Eoraptor and Saltoposuchus) 12/13 21:48

221 First mammals (shrew-like) 12/14 11:08

210 First turtles 12/15 8:05

**208 Jurassic system begins 12/15 11:53**

195 Dilophosaurus, an early Jurassic dinosaur 12/16 12:39

155 First bird, Archeopteryx 12/19 16:49

152 Apatosaurus and Brachiosaurus (long-necked) 12/19 22:32

150 Allosaurus, (meat-eating dinosaur) 12/20 2:20

148 Stegosaurus, (plate-backed dinosaur) 12/20 6:09

**144 Cretaceous system begins 12/20 13:46**

115 First flowering plants 12/22 21:00

82 Duck-billed dinosaurs (Maiasaurus) 12/25 11:50

80 Protoceratops (first dinosaur eggs discovered) 12/25 15:39

75 Triceratops 12/26 1:10

70 Tyrannosaurus rex and Velociraptor 12/26 10:41

65 End of Mesozoic, probably meteor or comet impact 12/26 20:13  
**Cenozoic, the "Age of Mammals"**  
**65 Tertiary system begins 12/26 20:13**  
64 First ancestors of dogs and cats 12/26 22:07  
60 Grasses become widespread 12/27 5:44  
57 First ancestors of pigs and deer 12/27 11:27  
55 First horses (Eohippus) 12/27 15:15  
45 First ancestors of rabbits 12/28 10:18  
39 First monkeys 12/28 21:43  
4 Oldest human like ancestors (hominids) 12/31 17:20  
**2 Quaternary system begins 12/31 20:57**  
1 First of four ice ages 12/31 22:05  
1 Oldest direct human-ancestor fossil, Homo habilis 12/31 23:02  
0.1 First modern man, Homo sapiens 12/31 23:48  
0.05 Mammoth and mastodon bones, Big Bone Lick, KY 12/31 23:54  
235 years Revolutionary War 12/31 23:59  
70 years World War II 1/1 0:00

The scale of geologic time is vast, currently estimated at nearly 4.6 billion years. During that time, life evolved into the familiar forms we see today. These materials are provided to assist in understanding time relationships and how life on Earth changed through time.

The dates shown were compiled from several available sources. Table 1 shows some important events in Earth history, presented in the order in which they occurred. The data are also shown on the scale of a calendar year. When geologic time is compressed to the scale of a calendar year, 1 second equals about 146 years. At this scale, World War II began about 0.4 second before midnight on December 31; because of rounding, this is shown as midnight of the new year.

On the back of this sheet is a chart showing the geologic eras, systems, and series; the oldest is at the bottom. On the chart, each dot, number, or letter represents 1 million years. The dots get "older" as you read down the chart, or to the right along a row. Thus, they represent millions of years before present ("mybp") and show the ages of the oldest known fossils of selected animals or the time of an event. Not all of the items shown in Table 1 are shown on the chart because of space limitations.

For more information on the geologic time scale, see:

- [www.uky.edu/KGS/education/activities.html](http://www.uky.edu/KGS/education/activities.html)
- Dinosaurs: Fact & Fiction [pubs.usgs.gov/gip/dinosaurs/](http://pubs.usgs.gov/gip/dinosaurs/)
- Fossils, Rocks, and Time: [pubs.usgs.gov/gip/fossils/](http://pubs.usgs.gov/gip/fossils/)
- Geologic Time: [pubs.usgs.gov/gip/geotime/](http://pubs.usgs.gov/gip/geotime/)
- Teaching About Evolution and the Nature of Science: [books.nap.edu/books/0309063647/html/index.html](http://books.nap.edu/books/0309063647/html/index.html)
- Learning from the Fossil Record [www.ucmp.berkeley.edu/fosrec/fosrec.html](http://www.ucmp.berkeley.edu/fosrec/fosrec.html)
- Understanding Evolution: [evolution.berkeley.edu/](http://evolution.berkeley.edu/)
- National Center for Science Education: [www.natcensci.ed.org/](http://www.natcensci.ed.org/)

The Kentucky Geological Survey is a research and public-service center of the University of Kentucky.

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On the Web: [www.uky.edu/KGS](http://www.uky.edu/KGS)

Scan this for more on geologic time

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Geologic Time Scale

Name \_\_\_\_\_

Birth date \_\_\_\_\_

Time of birth \_\_\_\_\_ AM or PM

1. Based on our timeline, in which geologic time period is your birthday?
2. What are three events that happened in this geologic time period?
3. We keep track of time (minutes, hours, months, years...) in different ways based on the movement of the Earth around the sun, and the spinning of the Earth on its axis. This is not how the length of the different eras is determined. How was it decided that one time period ended and another began? Give examples.
4. What evidence do scientists use to determine when a type of animal became extinct? How valid do you think their evidence is? Explain.



*Sample event strips, more, or different, strips can be created from the geologic time scale list.*

\*Earth formed

\*Inferred origin of  
life

(first cells)

\*Oldest aged-dated  
rocks on Earth

**\*Fossil evidence of  
bacteria**

**\*Fossil evidence of  
cells with a nucleus**

**\*First multi-cellular**

**organisms** (seaweed and algae)

**\*First fish**

**\*First fossil**

**evidence of land**

**plants**

**\*First insects**

**\*First land animals**

**(amphibians)**

**\*First sharks**

**\*First possible**

**reptiles**

\*End of Paleozoic -  
96% of all life on  
Earth perishes

\*First flowering  
plants

\*Triceratops

\*End of Mesozoic -  
probably meteor or  
comet impact

\*First ancestors of  
dogs and cats

\*First horses

\*Oldest human like  
ancestors

\*First of four ice  
ages

\*First modern man

\*Revolutionary War

\*World War II

\*PRECAMBRIAN

\*PALEOZOIC

\*MESOZOIC -

AGE OF REPTILES



**\*CENOZOIC -**

**AGE OF**

**MAMMALS**

