

Understanding Earth's Changes Over Time

http://www.nps.gov/archive/macala/learnhome/cur_p_tim.htm

Focus on Inquiry

The student will place geologic events on a both a relative geologic time scale and a scale model of absolute geologic time.

Lesson Overview

In this activity, students use a long paper strip and a reasonable scale to represent visually all of geologic time, including significant events in the development of life on earth as well as recent human events.

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| Duration 2 class periods | Setting Classroom | Grouping Individual or small groups | PTI Inquiry Subskills 3.2, 3.3, 3.6, 4.2, 4.4, 5.8, 7.2, 7.3 |
|------------------------------------|-----------------------------|---|--|

| Lesson Components | Estimated Time | Inquiry Subskills Used | Technology Used | Level of Student Engagement | Brief Description |
|------------------------|----------------|-------------------------|-----------------|-----------------------------|--|
| Engage | 10 min | 3.6, 4.2, 5.8 | None | 3 | Students choose an historical event and place themselves in relative order of occurrence. Then they place themselves on a timeline. Students discuss differences between the two types of timelines. |
| Explore/Explain | 35 min | 3.2, 3.3, 3.6, 5.8, 7.3 | None | 3 | Students create a scale to use for the geologic timelines they will use. They place the geologic periods on the timeline and then place geologic events in relative order and then on their timeline using absolute dates. |
| Expand | 20 min | 3.2, 4.4 | None | 3 | Students change the scale of their timeline and discuss the effects of the timeline. |
| Evaluate | 20 min | 4.4, 7.2 | None | 3 | Students calculate length of timeline that their historical timeline scale would require for all of geologic time. |

Level of Student Engagement

| | | |
|---|----------|--|
| 1 | Low | Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction |
| 2 | Moderate | Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance |
| 3 | High | Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered |

National Science Education Standards – Inquiry

Use appropriate tools and techniques to gather, analyze, and interpret data.
Develop descriptions, explanations, predictions, and models using evidence.
Communicate scientific procedures and explanations.



National Science Education Standards – Earth Science

Fossils provide important evidence of how life and environmental conditions have changed.

Louisiana Grade Level Expectations – Inquiry

Gr. 8, Inquiry GLE#6 — Select and use appropriate equipment, technology, tools, and metric system units of measurement to make observations (SI-M-A3)
Gr. 8 Inquiry GLE#11 — Construct, use, and interpret appropriate graphical representations to collect, record, and report data (e.g., tables, charts, circle graphs, bar and line graphs, diagrams, scatter plots, symbols) (SI-M-A4)
Gr. 8, Inquiry GLE#14 — Develop models to illustrate/explain conclusions reached through investigation (SI-M-A5)
Gr. 8, Inquiry GLE#19 — Communicate ideas in a variety of ways (e.g., symbols, illustrations, graphs, charts, spreadsheets, concept maps, oral and written reports, equations) (SI-M-A7)
Gr. 8, Inquiry GLE#22 - Use evidence and observations to explain and communicate the results of investigations (SI-M-A7)



Louisiana Grade Level Expectations Earth Science

Gr. 8, GLE#31 — Compare fossils from different geologic eras and areas of Earth to show that life changes over time (ESS-M-B1)

Gr. 8, GLE#32—Interpret a timeline starting with the birth of the solar system to the present day (ESS-M-B2)

Materials List (per group)

- A paper strip, such as adding machine tape or shelf paper
- A meter stick
- Masking tape or cellophane tape
- Writing utensils (pens, pencils, colored pencils, markers)

Advance Preparation

1. Obtain materials listed in the materials list.
2. Make enough student copies of **Blackline Master #1** (Student Investigation Sheet A).
3. Create index cards for the list of events on the Paleo Time Line at the end of the lesson. Do not put the absolute date on the cards (just write the event).

Other Information

Learning Objective

The learner will:

- determine appropriate scale to create models.
- determine the relationship between human events, events in earth's history, and the total age of the earth.
- compare fossils from different geologic eras and areas of Earth to show that life changes over time

Prior Knowledge Needed by the Students

- None

Procedure

Engage (Activity 1)

1. Have students create a list of historical events that they have studied. Have them choose one of the events and create a small symbol (or picture) that represents their event as well as identify the date of the event.
2. Have students stand in a line in the order of their events. (Don't worry about the spacing). Ask them if they are in the correct order. Which is the most recent event? Oldest event? On the chalkboard (or on a long piece of adding machine tape) ask students what would be a good interval to represent this time span. Now have the students space their pictures on the timeline to show the amount of time between their events. Which of the timelines would represent an "absolute timeline"? The order that they were in at the beginning of class or their events on the timeline? Which would be a "relative timeline"?
3. Ask students how long a million years are. How would students count or measure a million of anything? Use this discussion to help students arrive at the following questions: How does a million years, or even the time since the last ice age, compare with the age of the earth? Suppose you want to make a visual model showing a time line of the earth's history, how would you proceed?

Explore/Explain (Activity 2)

1. Students might need help in understanding how to set up a scale that can be displayed in the classroom or adjacent hallway. A reasonable scale is 1 inch to 1 million years. Depending on available space, larger unit distances will be easier to work with. Regardless of the scale the students choose, the last million years will be difficult to plot. Allow students to work out a scale on their own. NOTE: You can do this step ahead of time and have the timeline tape ready to go – or you can have your students prepare a class tape or a tape for themselves.

2. Provide students with **Blackline Master #1**. Have them mark these dates on their paper tapes.
3. Give each student (or pair of students) one of the events listed in the Paleo Time Line (located at the end of the lesson). NOTE: It is best to write each event on an index card without the absolute date.
4. Have students stand in the order that they think the events occurred in (youngest to oldest). Using the information from the Paleo Time Line go through the students' order and help them understand which event occurred most recently. Go through all the events. What type of timeline is this? (relative timeline)
5. Have students, now that they are in the correct order, place themselves on timeline at the time they think the event occurred. Using the information from the Paleo Time Line lesson, go through the students and discuss how long ago each event occurred. What type of timeline is this? (absolute timeline)

Expand

1. Change the scale for your timeline. (See Step #3 of the online lesson). This time try using one-foot equals one million years. Have each student recalculate the new distances. You could mark off your new time line outdoors in the school playground or along the school football field. Use flags or signs to show each event. NOTE: The older events may extend past the end of the football field. Instruct the students to find a landmark on their way home (from the bus or car window) that would be equivalent to the beginnings of life on earth! How far will they need to travel to find the first life forms or the start of geologic time? How does changing the scale affect the timeline? Does it affect the relative order? Does it affect the absolute date?

Evaluate

1. Ask students to calculate the length of a paper strip necessary to represent all of geologic time when using the extended scale they used to show the most recent events.
2. Have students write a short news article explaining their scale of geologic time and the evolutionary changes in the earth's lithosphere, atmosphere, and biosphere.

Blackline Master

1. Geologic Events

Supplementary Resources

University of California Museum of Paleontology

<http://www.ucmp.berkeley.edu/exhibits/geologictime.php>

This website has a timeline with links that give additional information about specific time periods in Earth's history.

United States Geological Survey (USGS): Fossils, Rocks, and Time

<http://pubs.usgs.gov/gip/fossils/contents.html>

This website contains information about rock layers, fossils, geological time, and other information related to the formation of rock layers.



Geologic Events (in Years Before the Present)

1. Oldest known rocks and fossils, 3.8 billion years ago.
2. First known plants (algae), 3.2 billion years ago.
3. First known animal (jellyfish), 1.2 billion years ago.
4. Beginning of the Cambrian and first abundant fossils, 550 million years ago.
5. Beginning of the Ordovician and first backboned animals, 500 million years ago.
6. Beginning of the Silurian and the first land plants, 440 million years ago.
7. Beginning of the Devonian and the first amphibians, 400 million years ago.
8. Beginning of the Mississippian, 350 million years ago.
9. Beginning of the Pennsylvanian and the first reptiles, 305 million years ago.
10. Beginning of the Permian, 285 million years ago.
11. Beginning of the Triassic and first dinosaurs, 245 million years ago.
12. Beginning of the Jurassic and first mammals, 205 million years ago.
13. First birds, 150 million years ago.
14. Beginning of the Cretaceous, 140 million years ago.
15. Beginning of the Paleocene and first primates, 65 million years ago.
16. Beginning of the Eocene, 60 million years ago.
17. Beginning of the Oligocene and first elephants, 35 million years ago.
18. Beginning of the Miocene, 25 million years ago.
19. Beginning of the Pliocene, 5 million years ago.
20. First humanlike animals, 2 million years ago.
21. Beginning of the Pleistocene and ice ages, 1 million years ago.
22. Last ice age, 10,000 years ago.