

PALEO SLEUTHS

— DIGGING DEEPER —

Investigating the Past Using a Geologic Time Scale



In this activity, students in groups of three will construct a vertical representation of a Geologic Time Scale and research facts, events, and organisms that differentiate between Time Scale Eras, Periods, and Epochs.

Teacher Background Information

1. Activity length: 2-3 days depending on the time needed for research
2. Grades 4 - 8 can experience this activity. Some extensions for Grades 6-8 are noted.
3. Vocabulary:
 - Geologic Time Scale - a system of chronological measurement relating stratigraphy to time, used by geologists to describe events occurring in Earth's geologic history through rock and fossil records. (See attached 8 x 11 copy for activity)
 - Chronological - the order in which events occurred
 - Stratigraphy - the order and relative position of strata, or layers of rock
 - Chronostratigraphic- the order and ages of layers of rock
4. Eras on the Geologic Time Scale
 - Cenozoic - known as the Age of Mammals, Present to 66 ma
 - Mesozoic - known as the Age of the Dinosaurs, 66 ma to 252.17 ma
 - Paleozoic - known as the Age of Ancient Life, 252.17 ma to 541 ma
 - Precambrian - is the earliest of geologic ages, 541 ma to 4.6 billion years ago

There are various areas of study under Geology. Paleontology is the study of fossils of animals and plants, microorganisms, and the traces they leave behind. Paleontologists study fossils to understand past life forms and changes through time. With the study of fossils, paleontologists can reconstruct the past history of the earth, animals and plants that lived in those times, and the environment that impacted those organisms. They study the evolution and extinction of organisms through the fossil record they encounter.

To find the history of the Earth, scientists look at rock and sediment layers. Each layer indicates a page in time of Earth's history. Several layers create a chapter of time, like in a book, noted as Eras, Periods, and Epochs. The oldest layers being at the bottom of the Time Scale and the youngest layers being at the top. It is important for students to understand the layering of rocks and sediment oldest to youngest as scientists tell time through this evidence. This is represented in the vertical design of the Geological Time Scale.

Teacher Materials:

- Clear plastic tennis ball tubes, 3 per group of 3 students
- Color copies of the International Chronostratigraphic Chart - 1 per group - place inside a clear plastic sleeve to protect it and reuse it for multiple classes (Print off PDF file)
- 1 of each of the vertical Geologic Time Scale worksheets per group-Top, Middle, and Bottom (Print off PDF files of these 3 worksheets)
- Set of colored pencils
- Scissors and clear tape



Tennis ball tubes can be found at any Tennis Court. Ask for clear tubes. Tennis clubs will recycle them, so call ahead and see how many you can have them save to be picked up. These containers can be reused in following years.

Teacher Procedures:

1. Students are in groups of 3.
2. Each group needs 3 clear tennis ball tubes.
3. Each group gets 1 colored copy of the Chronostratigraphic Chart 2015 along with the 3 vertical Geologic Time Scale worksheets, Top, Middle, and Bottom. (Print off PDF files)
4. Groups determine which Era each member will research, Cenozoic, Mesozoic, or Paleozoic
5. Groups research Eras, locating facts, events with years, and organisms.
6. Students follow the directions on the "Top" document of the time scale worksheet to create their vertical Geological Time Scale.
 - Grades 6-8:
 - Within each Era, students can divide into Periods or Epochs to do more in depth research.
 - We used centimeters as our scale of measurement. This is not to scale, so students could use math calculations to figure out a more approximate distance between Eras.
7. When research has been completed, students will place key points of information on their vertical Time Scale worksheets, color in the Eras, and Periods or Epochs, according to the Chronostratigraphic Chart, using it as a resource.
8. Then students cut the top dotted line of each Time Scale worksheet to fit inside the tennis tube, roll each of the three vertical Geological Time Scale worksheets, with researched facts, until the paper lines match, tape worksheet together and insert into each tennis ball tube.
9. Stack tennis ball tubes from bottom to top, oldest to youngest layers, not using the lids for the bottom and middle tubes, only the lid on top. Tape the tubes together.
10. Students share their key points of information with their peers and display the geologic time scale.

Extensions for Grade 6-8

Students create a life size representation of the Geological Time Scale to be displayed in a hallway or Media Center of their school. By displaying a larger version, the information is shared throughout the school, informing other students about the Geologic Time Scale and its history.

Students identify Era to Periods to Epochs in millions of years as they convert small measurement into a larger one that can actually be stepped off by them. Students complete research, locating facts, diagrams, events, and provide drawings of species of each Era to add to their Time Scale. This activity can be done in several days during a quarter.



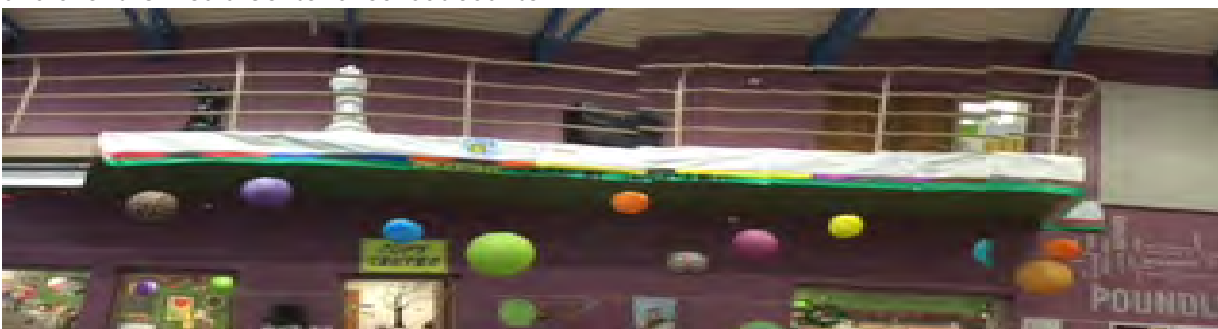
We concentrated our research on the mammals of Ashfall Fossil Beds to inform the rest of our student body about the importance of this National Nebraska landmark.



Our Geological Time Scale was displayed in our Media Center across the windows



and over the Media Center checkout counter



Our Media Center created an optional research activity during the lunchtime and after school for other students. Students did individual research on various organisms in Eras, adding diagrams and facts to our Geologic Time Scale.

Extension Materials:

Large roll of poster paper (approximately 2 feet wide)

1 color copy of the Chronostratigraphic Chart, place in plastic sleeve

Meter sticks

Color marker and pencils

Other colored construction paper and office paper for individual diagrams

Extension Procedures:

1. Students use the Chronostratigraphic Chart to convert the measurement of time to a larger scale-for every centimeter of time within an Era on the chart, convert to a meter of time on poster paper.

Example: Chart measures Cenozoic as 9 cm; converted to 9 meters of poster paper

2. Tape long pieces of poster paper together to make the lengths needed for each Era

3. Create Titles of Eras for each section and color code add Periods and Epochs to Eras and color code.

4. Students research the Eras, Periods, and Epochs, locating facts, species, adding drawings with labels, and events to add to their Geologic Time Scale.

Activity Resources

1. International Chronostratigraphic Chart 2015 - included in this activity International Commission on Stratigraphy, www.stratigraphy.org (Print off PDF file)
2. Ashfall Fossil Beds website <http://ashfall.unl.edu/index.html>.
3. *Ashfall Fossil Beds* State Historical Park & National Natural Landmark, Present view of an Ancient Past Visitor Guide.
4. ANDRILL: andrill.org/education - this activity is an adaptation of an activity titled "Stacking Up the Atmosphere" designed by ANDRILL and can be found in their educational materials.
5. JOIDES Resolution-an ocean drilling research vessel, drills for core samples of sediment and rock to indicate Earth's geologic and climate past. Check out how this ship cores and where they are currently drilling back in time beneath the ocean floor at joidesresolution.org.
6. Tennis ball tubes can be obtained usually for free from any tennis ball court or club.

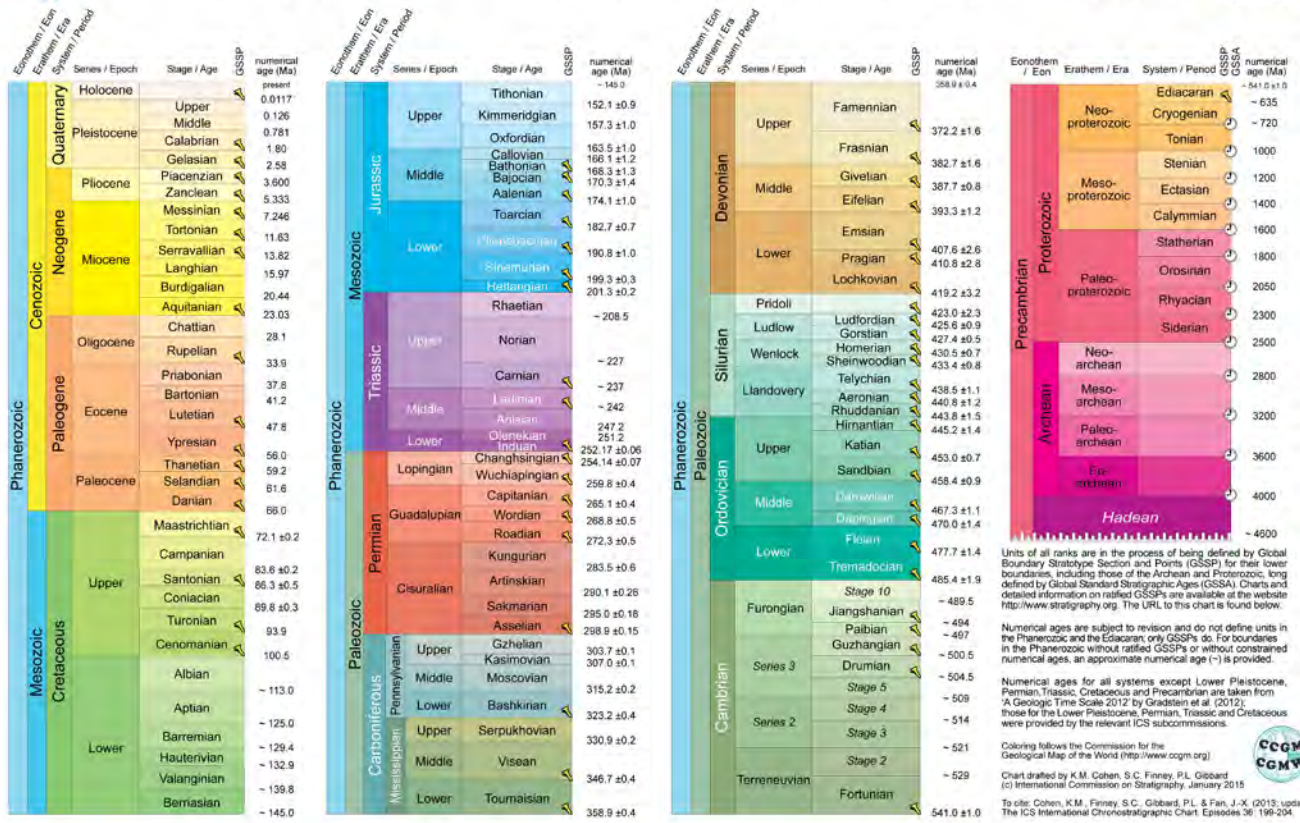


INTERNATIONAL CHRONOSTRATIGRAPHIC CHART

www.stratigraphy.org

International Commission on Stratigraphy

v 2015/01



Units of all ranks are in the process of being defined by Global Boundary Stratotype Section and Points (GSSP) for their lower boundaries, including those of the Archean and Proterozoic, long defined by Global Standard Stratigraphic Ages (GSSA). Charts and detailed information on ratified GSSPs are available at the website <http://www.stratigraphy.org>. The URL to this chart is found below.

Numerical ages are subject to revision and do not define units in the Phanerozoic and the Eocene; only GSSPs do. For boundaries in the Phanerozoic without ratified GSSPs or without constrained numerical ages, an approximate numerical age (–) is provided.

Numerical ages for all systems except Lower Pleistocene, Permian, Triassic, Cretaceous and Precambrian are taken from 'A Geologic Time Scale 2012' by Gradstein et al. (2012); those for the Lower Pleistocene, Permian, Triassic and Cretaceous were provided by the relevant ICS submissions.

Coloring follows the Commission for the Geological Map of the World (<http://www.cgmw.org>)

Chart drafted by K.M. Cohen, S.C. Finney, P.L. Gibbard (c) International Commission on Stratigraphy, January 2015

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URL: <http://www.stratigraphy.org/ICSChart/ChronostratChart2015-01.pdf>

National and State Standards

Next Generation Science Standards

Middle Level	MS-LS4-1.	Analyze and interpret data for patterns in the fossil record that document the existence, diversity extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
	MS-LS4-2.	Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
	MS-ESS1-4.	Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

Nebraska State Standards

Grade 3-5	SC5.1.1	Students will plan and conduct investigations that lead to the development of explanations.
	SC5.1.2	Students will describe how scientists go about their work.
	SC5.1.2.a	Recognize that scientific explanations are based on evidence and scientific knowledge
Grades 6-8	SC8.1.1	Students will design and conduct investigations that will lead to descriptions of relationship between evidence and explanations.
	SC8.1.2	Students will apply the nature of science to their own investigations.
	SC8.1.2.a	Recognize science is an ongoing process and the scientific community accepts and uses explanations until they encounter new experimental evidence not matching existing explanations
	SC8.4.4	Students will use evidence to draw conclusions about changes in Earth.
	SC8.4.4.a	Recognize that Earth processes we see today are similar to those that occurred in the past (uniformity of processes)
	SC8.4.4.b	Describe how environmental conditions have changed through use of the fossil record

Investigating the Past

Using a Geologic Time Scale

Activity



We know that the dinosaurs went extinct 66 million years ago. But what about other time markers in geologic history? How do we know what organisms lived in the past? How can we show geologic time?

Geologic history is told through research done by scientists of the rock, sediment, and fossil records found in the layers of the Earth over thousands to millions to billions of years. We can show this time, from the oldest age of layers at the bottom to the youngest age of layers at the top, represented in the Geologic Time Scale.

Objective:

Students will

- Demonstrate an understanding of a Geologic Time Scale through completion of research on past climates, events, and organisms that differentiate between the Eras, Periods, and Epochs of a geological time scale.
- Construct a vertical representation of a Geological Time Scale using acquired research.

Vocabulary to Know:

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- Scissors and clear tape.



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5. Groups research Eras, locating facts about organisms living years, and organisms.
6. Students follow the directions on the "Top" document of the time scale worksheet to create their vertical Geological Time Scale.
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