Teaching Activity: Reading Geologic Time

Introduction: Though much of geologic time was *azoic*, or without life, geologic interpretation often involves the observation and interpretation of fossils- the remains or evidence of living things. The fossil evidence often tells its own story and in the process presents valuable information not only on the appearance of different kinds of life, but also on the evolution of the Earth itself. The story of the geologic and biologic evolution of the past is found among the details of large-scale rock structures and minute *morphology*, or form, in fossils.

The *geologic time scale*, a type of classification system itself, has been affected by the changing interpretation and classification of fossil evidence and geologic events. The time scale is a *model* that organizes many years of evidence and interpretation and will help you to understand the history the Earth itself has written.

Geologic time has been divided into eras, periods, and epochs based on various changes such as extinctions, seen in the record of life. Geologic events, including *orogenies* (periods of mountain building) have also been used to mark divisions within the time scale.

Objective:

- To identify and understand the divisions of the geologic time scale;
- To analyze what geologic and biologic changes have occurred throughout geologic time;
- To create a scale model of the geologic time scale to describe the different eras, periods and epochs;

Important Terms: Geologic Time Scale, Precambrian, Paleozoic Mesozoic, Cenozoic. Era, period, epoch, extinction, orogeny, evolution, primitive, morphology, model;

Materials: Copy of the Geologic Time Scale, 5 meters of paper tape, meter stick, paper/pencil, colored pencils;

Procedure:

1. Review the attached geologic time scale with the class.

2. With the class, determine a scale that will allow students to list the eras, periods and epochs on the 5 m of paper tape provided.
   - Check individual student attempts before proceeding.

3. Beginning with the earliest, or Precambrian, era of 4600 million (4.6 B) years ago, students should plot the beginning of each era, period or epoch on the tape according to the scale decided upon.
   - Students should plot from the past toward the present. For example, the next period plotted after the Precambrian era would be the Cambrian, which began 570 M years ago and lasted 70 million years.

- Next came the Ordovician period, which also lasted 70 million years. Therefore, the Ordovician began 500 million years ago.
- Students should continue to plot the beginning of each period until they reach the Quaternary.
- Students should illustrate/ make brief notes on the tape the geologic or biologic events which highlighted each of the eras of periods labeled. Illustrations should be colored in.

4. Students should answer the questions in the **Analysis and Conclusions** section.

Student Activity Sheet: Reading Geologic Time

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Procedure:

1. Review the attached geologic time scale with your teacher. Take notes as the discussion proceeds.

2. With your class, determine a scale that will allow you to list the eras, periods and epochs on the 5 m of paper tape provided.

3. Beginning with the earliest, or Precambrian, era of 4600 million (4.6 B) years ago, plot the beginning of each era, period or epoch on the tape according to the scale decided upon.
   - Plot from the past toward the present. For example, the next period plotted after the Precambrian era would be the Cambrian, which began 570 M years ago and lasted 70 million years.
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4. Answer the questions in the **Analysis and Conclusions** section.

Student Activity Sheet #1

ANAYSIS AND CONCLUSIONS

1. What is the Geologic Time Scale? _____

2. On the basis of what evidence can geological history be divided into time units?

3. Some of the earliest evidence of life, in the form of algae, that has been recorded is 2600 M years old. According to this evidence, how much of the Precambrian era passed before the emergence of life? _____

4. What percentage of the Earth's total age was the Precambrian era? _____

5. How does the length of the existence of humans compare with the length of the entire time scale?_____

6. As you can see, the Geologic Time Scale is divided into 3 eras. What are they and what do their scientific name mean? _____

7. What are the three eras divided into? _____ List them _____

8. At the beginning of what period in Earth's history did there appear to be a dramatic increase in the number and diversity of life forms?_____
What evidence if there of life on Earth before that period? _____

9. What dopes the fossil evidence suggest happened to many forms of life that existed on Earth in the past? _____

10. Many forms of life have become extinct. How does the number of species that have become extinct compare with those presently living? _____

_____

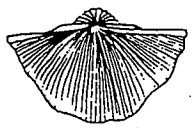
_____

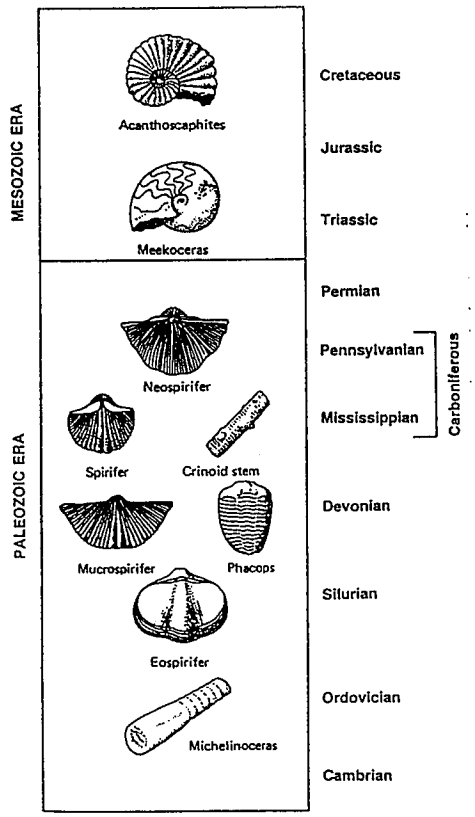
11. What percentage of the Earth's total age was the Quaternary period?_____
Why do you think it is called the "Age of Man"? _____

_____

_____

12. Fossils were found at 5 locations along a highway, as shown below. Refer to the picture of the index fossils on the left and answer the following questions.

location	1	2	3	4	5
FOSSIL	 Phacops	 Crinoid stem	 Neospirifer	 Spirifer	 Mucrospirifer



a. What sequence of ages can be inferred from locations 1-5?

b. What type of rock structure (limestone or shale) could explain the fossil record as it appears at the surface?

c. What evidence for evolution do fossils #3- 5 provide?

THE GEOLOGIC TIME SCALE

Era		Period (or Epoch)		Millions of Years Ago	Plant Life	Animal Life
CENOZOIC ERA	Age of Man	Quaternary	Recent Epoch		Herbs dominant	Modern man and modern animals
			Pleistocene Epoch	.01	Trees decrease; herbs increase	Early man; large mammals become extinct
	Age of Mammals	Tertiary Period	Pliocene Epoch	2	Grasses increase; herbs appear	Mammals abundant; man appears
			Miocene Epoch	12	Forests decrease; grasses develop	Mammals increase; hominids appear
			Oligocene Epoch	26	Worldwide tropical forests	Modern mammals appear
			Eocene Epoch	37	Angiosperms increase	Archaic mammals at peak
			Paleocene Epoch	53	Modern angiosperms appear	Archaic placental mammals appear; modern birds
MESOZOIC ERA	Age of Reptiles	Cretaceous Period		65	Conifers decrease; flowering plants increase	Large reptiles (dinosaurs) at peak, then disappear; small marsupials; toothed birds; modern fishes
		Jurassic Period		136	Conifers, cycads dominant; flowering plants appear	Large reptiles spread; first birds, modern sharks and bony fishes; many bivalves
		Triassic Period		190	Conifers increase; cycads appear	Reptiles increase; first mammals; bony fishes
PALEOZOIC ERA	Age of Amphibians	Permian Period		225	Seed ferns disappear	Amphibians decline; reptiles increase; modern insects
		Carboniferous Period		280	Tropical coal forests; seed ferns, conifers	Amphibians dominant; reptiles appear; rise of insects
	Age of Fishes	Devonian Period		345	First forests; horsetails, ferns	Early fishes spread; amphibians appear; many mollusks, crabs
	Age of Invertebrates	Silurian Period		395	First land plants	Scorpions and spiders (first air-breathers on land)
		Ordovician Period		430	Algae dominant	First vertebrates; worms; some mollusks and echinoderms
		Cambrian Period		500	Algae, fungi; first plant spores	Most invertebrate phyla; trilobites dominant
PRE-CAMBRIAN				570	Probably bacteria, fungi	A few fossils; sponge spicules; soft-bodied invertebrates
				?	Life arises; no fossils	
				4,500		