**Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_**

**Determining Geologic Age of Rocks and Index Fossils**

**Part 2: Matching Geologic Time with Index Fossils and Rock Layers**

**Background Information**:

One of the most important uses of fossils is to determine the age of the rock layer in which it has been found. Suppose a species exists for only a short period of time before it becomes extinct. If this happens, then the fossils of this species will be found in only a single rock layer. However, if this species was widely distributed and is easily found and identified, then it is extremely useful in determining the age of the rock in which it is found. Fossils of this type are called **index fossils**, because they are such a useful guide in the dating of rock layers (Sutherland, 1984). A large number of these index fossils have been found and identified by geologists and paleontologists. Some of these are identified in *Table 1, Descriptions of Index Fossils,* and correspond to the plastic fossils that you will use in this section of the lab. These plastic fossils are scale models of the real fossils.

Fossils may have similarities that can help determine geologic age. For instance, trilobites belong to the same group of organisms called arthropods (crabs, spiders, insects and shrimp). Trilobites were common many millions of years ago in a segment of time called the Paleozoic Era (Paleozoic means “ancient life”). In fact, you can often buy real trilobite fossils in rock shops for a dollar or two. Some species of trilobites appear to have survived relatively unchanged for large periods of time, according to the fossil record. Other species, while having been widely distributed in many areas, appear to have existed for only a relatively short time before going extinct. It is important to realize that trilobites were a large and diverse group, which included many species, just like spiders today are a large and diverse group which include many species.

Today you will be using the index fossils in *Table 1, Descriptions of Index Fossils,* and the rock layer sequences that you arranged in the *Part 1: Correlating Rock Layers* activity to determine the geologic ages of the fossils and rock layers. You will also determine the length of time for each geologic era.

**Works Cited:**

Sutherland, B., et al. (1984) *Focus on Earth Science*. Columbus: Merrill.

**Materials:**

Table 1. Descriptions of Index Fossils

1 tub of plastic replicas of index fossils (should be 20 individual fossils)

Rock Layers Sequence (Part 1)

**Procedure:**

1. Make a grid on a piece of paper showing: Cephalopod, brachiopod, echinoderm, trilobite, pelecypod, and mammal. Group the plastic fossil models, on the grid you have made. Use Table *A. Descriptions of Index Fossils* to help you.
2. List the similar characteristics of each type of fossil in Table 1 below.Include as much QUALITATIVE data as you can. Remember that details are VERY important. Use Table *A. Descriptions of Index Fossils* to help you.
3. Using the information provided in *Table A. Descriptions of Index Fossils*, write the fossil number, the name, and the type of index fossils from Part 1 in the appropriate space on *Table 2. Geologic Time Scale of Index Fossils.* More than one fossil may be recorded in certain periods or epochs.
4. On *Table 2. Geologic Time Scale of Index Fossils:*
   1. Place the actual dates below the names of the periods.
   2. Calculate the length of time (number of years) of each era (ie 200 million years), and write this in the box for each era. *You will need to do math to calculate the number of years of each era; don’t just copy how many years ago the eras occurred.*
   3. ***HONORS*** *– Each* ***period*** *and* ***era*** *in earth history should be accurately reflected in your “History of the Universe” book.*

**Results: *Table 1. Index Fossil Characteristics***

|  |  |
| --- | --- |
| **Type of Fossil** | **Similar Characteristics** |
| Cephalopod |  |
| Brachiopod |  |
| Echinoderm |  |
| Trilobite |  |
| Pelecypod |  |

1. If you have looked closely at some of the fossils of sea turtles and wild pigs at the Denver Museum of Natural History, you will have noticed that they were both discovered in Colorado! Explain how both land and sea creatures came to be preserved in the rocks of a state a thousand miles from the ocean.

**INSERT**

**TABLE 1, DESCRIPTIONS OF INDEX FOSSILS**

**HERE**

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Per\_\_\_\_\_\_\_\_\_\_Date\_\_\_\_\_\_\_\_\_\_\_\_

**Determining Geologic Age of Rocks and Index Fossils**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Table 2. Geologic Time Scale of Index Fossils | | | | | | |
| Era | Period | | Epoch | Fossil # | Fossil Name | Type of Fossil |
| Cenozoic | Quaternary | | Holocene |  |  |  |
| Pleistocene |  |  |  |
| Tertiary | | Pliocene |  |  |  |
| Miocene |  |  |  |
| Oligocene |  |  |  |
| Eocene |  |  |  |
| Paleocene |  |  |  |
|  | | | | |  |  |
| Mesozoic | Cretaceous | | No Epochs |  |  |  |
| Jurassic | |  |  |  |
| Triassic | |  |  |  |
|  |  | |  |  |  |  |
| Paleozoic | Permian | | No Epochs |  |  |  |
| Carboniferous | Pennsylvanian |  |  |  |
| Mississipian |  |  |  |
| Devonian | |  |  |  |
| Silurian | |  |  |  |
| Ordovician | |  |  |  |
| Cambrian | |  |  |  |
|  |  | |  |  |  |  |
| Precambrian | No Periods | | No Epochs |  |  |  |

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Per\_\_\_\_\_\_\_\_\_\_Date\_\_\_\_\_\_\_\_\_\_\_\_

**Determining Geologic Age of Rocks and Index Fossils**

**Results**:

In the space below, list the sequence of rock layers from Part 1 and then list the new sequence based on the table (Table 2) that you just made.

**Part 1 Sequence** **New Sequence**

**Analysis**:

1. Which of the rock layers was the most difficult to place based on position in the set of outcroppings from Part 1? Did knowledge of index fossils help you to place the rock layers? Explain how neither layers nor index fossils by themselves provide enough information to determine the ages of rocks.

2. Life has been on Earth 3600 million years. The oldest human-like fossils are about 2 million years old. Calculate the percent of time with life that humans have been on Earth. Show all of your work in the space below.

3. Which of the four eras of the geologic time scale lasted the longest? For how many years did it last?

4. Which of the four eras is the shortest? For how many years has it lasted?

**Conclusion**:

1. Why did plants have to appear in the fossil record before animals?

2. How can the fossils of sea creatures end up in the rocks on the tops of mountains?

3. Why do you think that there are epochs only in the Cenozoic Era and no periods or epochs in the Precambrian Era?

4. Explain why scientists make divisions between eras, periods, or epochs as shown on the Geologic Time Scale.

5. Suggest a reason that the older eras are longer than the more recent eras.

**HONORS** – *Answer the following on the back of this page.*

A paleontologist finds a portion of an ancient bone in a section of sedimentary rock. The area of the discovery has many layers containing fossilized remains of numerous species of terrestrial and marine organisms. Explain, based on ***relative dating techniques***, how the scientist could understand how the climate of the area changed over time. Investigate ***absolute dating techniques*** and describe how the paleontologist could determine the age of the bone and possibly the life history of the animal from which it came.