How can fossil and rock data determine when an organism lived?

Fossils are the remains, imprints, or traces of organisms that were once alive. By studying fossils, scientists can learn where, when, and how those organisms lived.

Fossils are usually found in sedimentary rocks. This is because the intense pressure and heat that create igneous and metamorphic rocks often destroy fossils.

Scientists use special fossils, called index fossils, to date rocks. Index fossils are from species that existed on Earth for relatively short periods of time and were abundant and widespread. Index fossils found in a sedimentary rock layer can be used to help date the layer.

Another way a scientist might determine the age of a rock layer is by using the principle of superposition. This states that in undisturbed layers of rock the oldest rocks are on the bottom and the youngest rocks are towards the top. However, layers of rock do not always remain undisturbed. A fault could cause rock layers to overturn. In this case, scientists use relative dating to determine the order of events and the relative age of rocks by looking at the position of rocks in a sequence. Relative dating does not indicate the exact age of rock layers. It does indicate, however, that a layer is younger than the layers below it and older than a fault cutting through it.

Besides using index fossils, superposition, and relative dating, scientists also use a more precise method, called absolute dating, to date rocks. Absolute dating uses the radioactive decay of radioactive isotopes of minerals in rocks to determine the age of the rock. When a radioactive isotope (parent material) decays, it forms a new isotope, a daughter product. The half-life of a radioactive element is the time it takes for half of its atoms to decay into the daughter product. After two half-lives, one-fourth of the original isotope’s atoms remain and three-fourths have turned into the daughter product. After three half-lives, only one-eighth of the original isotope’s atoms still remain. After many more half-lives, a very small amount of the original parent isotope remains.

By measuring the amounts of parent and daughter materials in a rock and by knowing the half-life of the parent, a geologist can calculate the absolute age of the rock. This method is called radiometric dating.

In this Virtual Lab you will confirm or refute the age of a rare fossil and determine when the organism that produced it was alive. To date the fossil you will use radiometric dating of rock layers and information about index fossils.

Objective:

* Investigate relative and absolute dating of fossils

Procedure: Prepare a Data Table … See below

1. Begin at one of three dig sites. Click and drag a nail with a label to each of the four rock and sediment layers.
2. Drag the magnifying glass over the rock and sediment layers to look for fossils.

NOTE: a hand is displayed on the handle of the magnifying glass. As you move the magnifying glass, the layer the hand is one indicates the rock layer where a fossil may be located.

1. When you find fossils, compare them to those shown in the field guide. To access the field guide, click the laptop computer. Under Menu click Field Guide. Compare the geologic rock layers shown with those of the dig site. Click the Next button to research the fossils.
2. Record the names of the fossils and the layers in which you found them in your Data Table. Return to the dig site.
3. Click and drag the hammer to the layers you want samples from. The samples are placed in the try according to the layers from which they are taken.
4. Click and drag each of the samples to the utility truck’s front driver’s side window.
5. Click the utility truck’s window again to send the rock samples to the lab for absolute dating.
6. Click the laptop computer to check your email. Under Menu Click e-mail to read the results of the absolute dating tests.
7. Click the Next button and read the graph to determine the age of your rock sample. Find the flashing point on the graph. Convert the number of half-lives into millions of years. You may use the Calculator, if necessary. If you received data for more than one rock sample, click the Next button again and determine the age of this rock sample. Record your findings in the Table.
8. Describe your findings in the Journal.
9. Click the Reset button to explore another dig.
10. Continue until you have explored all three dig sites.
11. Answer the Journal Questions.

Data Collection: Prepare a Data Table like the one shown below….

\*(MYBP – Million years before present)

|  |  |  |  |
| --- | --- | --- | --- |
| **Geologic Time Period** | **Rock/Sediment Layers** | **Index Fossil Found** | **Rare, Undated Fossil** |
| Cenozoic Quaternary (1.6 MYBP) |  |  |  |
| Cenozoic Tertiary (64.4 MYBP) |  |  |  |
| Mesozoic Cretaceous (144 MYBP) |  |  |  |
| Mesozoic Jurassic  (208 MYBP) |  |  |  |
| Mesozoic Triassic  (245 MYBP) |  |  |  |
| Paleozoic Permian  (286 MYBP) |  |  |  |
| Paleozoic Pennsylvanian  (320 MYBP) |  |  |  |
| Paleozoic Mississippian  (360 MYBP) |  |  |  |
| Paleozoic Devonian  (408 MYBP) |  |  |  |
| Paleozoic Silurian  (438 MYBP) |  |  |  |
| Paleozoic Ordovician  (505 MYBP) |  |  |  |
| Paleozoic Cambrian  (544 MYBP) |  |  |  |
| Precambrian  (4,600 MYBP) |  |  |  |

Journal Questions:

1. What steps did you take to date the fossils you found?
2. What steps did you take to date the rock layers?
3. Does the information you collected from the dig site support the principle of superposition?
   1. Explain.
4. Describe how you determined the age of rare fossils you found.
5. Did your findings support the field guide information about the age of the rare fossils?
   1. Explain.