**Virtual Lab: How can fossil and rock data determine when an organism lived? SC.7.E.6.4, SC.7.E.6.3**

**http://www.glencoe.com/sites/common_assets/science/virtual_labs/ES12/ES12.html**

**Background:** 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 creates igneous and metamorphic rocks often destroy fossils.

Scientists use special fossils called index fossils, to date rocks. **Index fossils** are fossils from a 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 scientists might determine the age of a rock layer is by using the **principle of superposition**. This principle states that in undisturbed layers of rock, the oldest rocks are on the bottom and the youngest rocks are towards the top. However, layers do not always remain undisturbed. A fault could cause a rock layer to overturn. In this case, scientists use **relative dating** to determine the order of events and the relative ages of rocks by looking at the positions 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 remain. After many more half-lives, a very small amount of the original parent's 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.

**Procedure:**
1. Begin at one of the three dig sites. Click and **drag a nail** with a label into each of the four rock 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 on indicates the rock layer where a fossil may be found. You will need to move the magnifying glass slowly and carefully to find the fossils. If you go too quickly or don't search thoroughly you may miss some.
3. When you find fossils, compare them with 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.
4. Record the names of the fossils and the layers in which you found them in your **Table**. Return to the dig site.
5. Click and drag the **hammer** to the layers you want samples from. The samples will be placed in the tray according to the layers from which they are taken.
6. Click and drag each of the samples to the **Utility Truck's front driver side window**.
7. Click the **truck window** again to send the rock samples to the lab for absolute dating. (the truck will drive away)
8. Click the **laptop** computer to check your email. Under menu click **email** to read the results of the absolute dating tests.
9. 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 sample, click the **Next** button again and determine the age of that rock sample. Record your findings in the **Table.**
10. To explore a different site click the **Reset** button until you see a new site number that you have not explored near the top of the screen.

Name _____ Date _____ Per _____ Virtual Lab: Fossil Data

**Data Table: You may need to hit the refresh button in Internet Explorer several times to get the other dig sites to work and load properly.**

**Dig Site 1**

| Rock/Sediment Layer | Name of Fossils Found (at least 2 in layers 1 and 3) | Time Period of Fossil Found | Radiometric Dating Results (layers 2 and 4) |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

**Dig Site 2**

| Rock/Sediment Layer | Name of Fossils Found (at least 2 in layers 1 and 3) | Time Period of Fossil Found | Radiometric Dating Results (layers 2 and 4) |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

**Dig Site 3**

| Rock/Sediment Layer | Name of Fossils Found (at least 2 in layers 1 and 3) | Time Period of Fossil Found | Radiometric Dating Results (layers 2 and 4) |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

**Cenozoic Quarternary = 1.6 MYBP**   **Cenozoic Tertiary = 64.4 MYBP**   **Mesozoic Creaceous = 144MYBP**
**Mesozoic Jurassic = 208 MYBP**   **Mesozoic Triassic = 245 MYBP**   **Paleozonic Permian = 286 MYBP**
**Paleozonic Mississippian = 360 MYBP**   **Paleozonic Devonian = 408 MYBP**   **Paleozonic Silurian = 438 MYBP**
**Paleozonic Ordovician = 505 MYBP**   **Paleozonic Cambrian = 544 MYBP**   **Precambrian = 4600 MYBP**

**QUESTIONS:**

1.  What does the principle of superposition state?

2.  Does the information you collected from dig sites 1 and 2 support the principle of superposition? Explain.

3.  How can you explain the fact that at Dig site 3 there is an older rock layer above a younger rock layer?

4.  What steps did you take to date the rock layers? (Summarize your process)

5.  What is the difference between relative dating and absolute dating?

6.  Why could you use radiometric dating to date the igneous rock layers, but not the sedimentary rock layers?

7.  Give 1 benefit of using this virtual lab model of a geologic dig instead of actually going to a dig site.

8.  Give 1 drawback of using this virtual lab model of a geologic dig instead of actually going to a dig site.