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## Chapter 17 The History of Life

## Modeling Index Fossils

## Introduction

A fossil is the remains or evidence of an ancient living thing. Fossils of organisms that lived on Earth for only a short time are called index fossils. In this activity you will discover how index fossils can be used to determine the relative ages of rock formations.

## Problem

How can index fossils help determine the relative ages of rock formations?

## Pre-Lab Discussion

Read the entire investigation. Then work with a partner to answer the following questions.

1. What do the sand and the salt in the beakers represent?
2. How will you determine the number of "Years Ago" that leaves appeared?
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3. Which line in the Data Table represents the present time?
4. In the Data Table, how many millions of years are represented by 1 minute?
5. What is an index fossil?

## Materials (per group)

scissors
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construction paper
3 500-mL beakers or glass jars glass-marking pencil
small leaves
watch or clock with second hand sand
table salt

## Safety

Put on safety goggles. Put on a laboratory apron. Be careful to avoid breakage when working with glassware. Use caution with sharp instruments. Wash your hands thoroughly after handling plant materials and after carrying out this investigation. Note all safety alert symbols next to the steps in the Procedure and review the meaning of each symbol by referring to Safety Symbols on page 8.

## Procedure

1. Cut a large circle from a piece of construction paper. The circle represents Earth.
(1) 2. Use a glass-marking pencil to label the three beakers $\mathrm{A}, \mathrm{B}$, and C .
2. Place the construction-paper circle on a desk or table. Place each beaker in a different location on the circle. Each beaker represents the site of a rock formation on Earth.
3. Place a pile of small leaves near, but not on, the circle. The leaves represent an organism that once lived on Earth.
4. Choose a starting time a few minutes from now, and write that time in column 1 of the Data Table opposite the word "start." Then list the times at 3-minute intervals for the next 30 minutes. Your last time should be written opposite the word "stop."
5. In this activity 30 minutes represent 30 million years in Earth's history. In the column labeled "Years Ago (millions)," list the number of years represented by the times in column 1. Begin by writing " 30 " in the "start" row, then subtract 3 for each of the next 3 -minute periods. You should end up with 0 in the "stop" row.
6. With one partner serving as timer, wait until your watch or clock shows the starting time. Then, add about 2 cm of sand to beaker C . The sand represents a layer in the rock formation.
7. At the next listed time, add a $2-\mathrm{cm}$ layer of table salt to beaker C . The salt represents another layer in the rock formation.
8. At the next listed time, add a layer of sand to both beakers A and C.
9. At the next listed time, add a layer of salt to beakers $A$ and $C$.
10. At the next listed time, add a layer of sand to beakers $A$ and $C$.
11. The next time listed in the Data Table should correspond with the event "leaves appear." Move the pile of leaves onto the circle. At the correct time, add a layer of salt to beakers A, B, and C. As you add the salt, also add a leaf to each beaker so that the leaf becomes embedded in the salt. Be sure that you can see each leaf clearly throught the side of its beaker.
12. At the next listed time, move the leaves that you have not used off the circle and back onto the table. (This should correspond with the event "leaves die out" in the Data Table.) After you remove the leaves, add a layer of sand to beakers A and B.
13. At the next listed time, add a layer of salt to beakers A and B.
14. At the next listed time, add a layer of sand to beaker $B$.
15. At the next listed time, add a layer of salt to beaker B.
16. By now you should have reached the last time listed in the Data Table. Add a layer of sand to beaker B. Your beakers should now look like those shown in Figure 1.
$\qquad$ Class $\qquad$ Date $\qquad$

A

B

C

Figure 1
Data Table

| Time | Event | Years Ago (millions) |
| :--- | :--- | :--- |
|  | start |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  | leaves appear |  |
|  | leaves die out |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  | stop |  |

## Analysis and Conclusions

1. Inferring In your model, which "rock layers" are older-those on the top or those on the bottom? Explain why.
2. Calculating According to your Data Table, how many millions of years ago did leaves appear on Earth? How many millions of years ago did they die out, or become extinct?
3. Analyzing Data What must be true about the age of rock layers in which leaves appear? Why do you think so?
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4. Using Models On the diagram in Figure 1, use an arrow to identify each layer in which a leaf appears. Then label each layer to show the number of years ago that it formed. (For convenience, use the number of years that corresponds to when leaves appeared.)
5. Classifying What must be true about the age of the rock layers above the leaf in each beaker? Below the leaf?
6. Drawing Conclusions Based on your answer to question 5, which rock formation-A, B, or C-must be the oldest? Explain why.
7. Inferring Which rock formation must be the youngest? Why do you think so?
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8. Calculating Using the leaf as a guide, determine the age of the oldest and youngest rock layer in each beaker. Then label the layers in Figure 1 with this information. Which layers are the oldest and youngest in each beaker?
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9. Drawing Conclusions How are index fossils used to determine the relative ages of rock formations?
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## Going Further

Use the library or the Internet to research dinosaurs, and how scientists have determined when they lived. Did all species of dinosaurs live at the same time? Would dinosaur fossils be of any use as index fossils? Explain your answer.

