ACTIVITY 1: SANDWICH STRATIGRAPHY

Using a sandwich model, students will determine the relative ages of different "sedimentary rock layers" and experiment with "folding" and "faulting."

OBJECTIVES

Students will create a model to

- determine the relative age of a series of "sedimentary rock layers" by applying the Law of Superposition and
- experiment with "folding" and "faulting".

VOCABULARY

sedimentary rock	limestone	fold
conglomerate	sandstone	Law of Superposition
shale	fault	

MATERIALS

Each student or student group will need: a paper plate, slice of white bread, slice of light brown bread, slice of dark brown bread, spreader (knife or tongue depressor), 1 tablespoon of grape jelly, 1 tablespoon of soft chunky peanut butter, paper towels.

GETTING READY

Gather materials listed above. Have students wash their hands and wipe off their work area with a paper towel.

SETTING THE STAGE

1) Introduce each vocabulary term as it comes up in the activity.
2) Write the following information on the board:

   white sandstone = white bread
   light brown sandstone = light brown bread
   brown shale = dark brown bread
   purple limestone = grape jelly
   conglomerate = peanut butter

3) Tell students that each food item represents a specific sedimentary rock as noted.

DOING THE ACTIVITY

<u>Determining Relative Age Using The Law of Superposition</u>

1) Distribute the materials to each student.
2) Tell students to:
   a. Deposit the "white sandstone" on the paper plate.
   b. Spread a layer of "purple limestone" on top of it.
   c. Place the "brown shale" on top of the "limestone."
   d. Spread the "conglomerate" on top of the "brown shale."
   e. Deposit a layer of "light brown sandstone" on top.
3) Discuss the following questions as a class.
   a. Which is the oldest layer? Why? *The white sandstone, because it was deposited first. It is on the bottom; everything else came after it.*

b. Which is the youngest layer? Why? *The light brown sandstone is the youngest because it was put on top and was the last layer to be deposited.*
c. What is the relative age of the brown shale layer compared to the other layers? *It is older than the light brown sandstone and younger than the white sandstone.*
d. Tell students that this "sandwich" illustrates the Law of Superposition: A given sedimentary rock layer is younger than any of the sedimentary rock layers below it and older than any of the sedimentary rock layers above it.

Faulting and Folding

1) Tell students to "fold" the "sedimentary rock layers" to form a "valley" and "mountain slope."
2) Have students eat the highest parts of the folded sandwich ("mountain") until the top is "eroded" away. Are the newly exposed surface layers older or younger than the surface of the valley? *Older*
3) What happens when the sandwich is torn apart? *Faulting*
4) Now students can enjoy what's left of their sandwiches!

ACTIVITY 2: USING A GEOLOGIC TIMELINE TO REPRESENT THE EARTH'S HISTORY

Introduce students to the earth's geologic history, concept of geologic time, and the importance of fossils in determining the history of life on earth.

OBJECTIVES

Students will:

- become aware of how huge a million and a billion are in relation to time and quantity,
- describe the importance of fossils in determining the history of life on earth,
- develop an understanding of the earth's geologic history and how it can be represented on a geologic timeline,
- plot some events that occurred in the earth's history on the geologic timeline, and
- relate events that occurred in the Sonoran Desert's history to the geologic time scale.

MATERIALS:

- copies of the *Student Handout: Fantastic Fossils, Clues To The Past* (p.7) for each student
- 1-pound box of salt
- a piece of black construction paper
- adding machine tape 5 meters long for each group of students
- meter stick for each group of students

VOCABULARY:

geologic
paleontology
Precambrian Era
Paleozoic Era
Mesozoic Era
Cenozoic Era

GETTING READY
Prepare the materials as listed above.

SETTING THE STAGE
1) To assess prior knowledge and generate class discussion pose the following questions:
   a. According to scientists, how old is the earth? *4.6 billion years old*
   b. What is a fossil? *The remains or traces of a prehistoric organism.*
   c. Does the fossil record tell a complete story of life? *No, only a small percentage of organisms were ever fossilized.*
   d. How do fossils help us learn about ancient life? *They provide clues to past life.*
   e. Scientists who study fossils are called *(paleontologists).*

2) Pass out the *Student Handout* and have students read *Fantastic Fossils; Clues to The Past.*
3) Discuss the information covered.

DEMONSTRATION: How Much Is A Million?
1) Slowly pour the salt onto the black construction paper. Ask the students to stop you when
   they think you have poured a million salt grains onto the paper.
2) How much is a million? Keep pouring… If a one pound box of salt contains 100,000 grains, it would take 10 boxes to equal a million grains!
3) Remind students that scientists estimate the earth's age to be 4.6 billion years or 4,600 million years. Humans have only been around for about 2 million years. Think of how many
   grains of salt this would be equivalent to!

DOING THE ACTIVITY
Plotting the Events in the Earth's History on a Geologic Time Line
1) Tell students that they will be constructing a geologic time line with adding machine tape and plotting events from the earth's history on the timeline.
2) Divide the class into groups of two to three students.

Instructions
1) Put the chart below on the board and have students copy it into their notebooks.

Event	Years Before Present	Centimeters
Humans first land on the moon	30	
Humans arrive in Arizona	11,000	
Beginning of last Ice Age	80,000	
Early humans	2,000,000	
First elephants	40,000,000	
Cenozoic Era begins	65,000,000	
First birds	150,000,000	
Pangaea begins to break apart	200,000,000	

Mesozoic Era begins	230,000,000	
First insects	345,000,000	
First land plants	440,000,000	
Paleozoic Era begins	600,000,000	
Life on earth begins	3,500,000,000	
Precambrian Era begins	4,600,000,000	

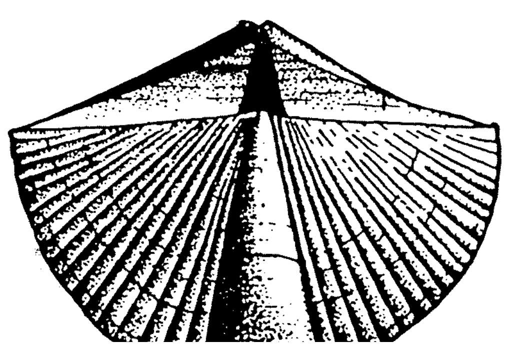
2) Write the following scale on the board: 1 meter = 1,000,000,000 years; 1cm = 10,000,000 years; 1mm = 1,000,000 years.
3) Show students how to use this scale to convert the times on the chart into distance (centimeters).
4) Once students have completed the conversions, have them measure out 5 meters of adding machine tape.
5) Mark 1 m intervals on the tape. Label the left end present time.
6) Have students plot the events from the chart on their timeline. Students may need to put some more recent events on paper arrows and tape these onto the timeline due to space constraints. Each event should be labeled.

DISCUSSION

1) Which is the longest era? The shortest era?
2) Compare the length of time of different events with the entire geologic record.
3) Compare the length of time that humans have been on the earth with the entire geologic record.

EXTENSIONS

1) <u>Living Timeline</u>: A living time line can also be constructed in an open space such as a ball
   field or gymnasium. Assign each student a geologic event, and have them calculate where they should stand in a line. Use a scale of 1 inch or 1cm for every million years. Once all students are in place, have them call off their events one by one.
2) At the Desert Museum, be sure to have students do the activity in *CLUES TO ARIZONA'S*
   PREHISTORIC PAST: DESERT MUSEUM EXHIBIT GUIDE (pp.9-10)dealing with geologic time at the Earth Science Ramp.
3) After completing the *Arizona's Prehistoric Past Lab* at the Desert Museum, have students
   add events learned in the lab to their class time line.



NAME ___________________________________ **Activity 2:** *Student Handout*

FANTASTIC FOSSILS: CLUES TO THE PAST

Geologic Time

Scientists estimate the earth to be about 4.6 billion years old. How long is 4.6 billion? If you were to begin counting at the rate of one number per second and continued 24 hours a day, 7 days a week, and never stopped, it would take about 150 years to reach 4.6 billion! Wow, that's a long time!

In order to understand the geologic history of the earth, we must learn to think in <u>enormous</u> spans of time. Even though to us mountains and valleys seem to be the same every day, they are actually slowly changing. Over millions of years, mountains rise and are eroded into hills, and water slowly digs deep canyons.

When the earth first formed, there were no living creatures. Scientists think life began on earth about 3.5 billion years ago (bya). They believe the first living things were tiny bacteria. Many other ancient organisms lived and died over millions of years on our earth. Scientists study fossils to learn about this ancient life.

What is a fossil?

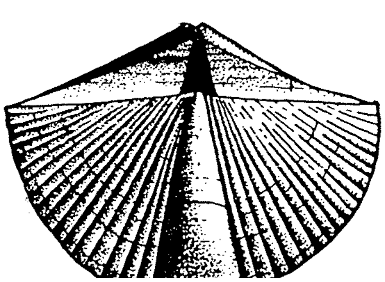
Fossils are any remains of ancient life preserved in rock. Fossils range from huge dinosaur skeletons and mammoth teeth, to animal footprints and microscopic grains of pollen. Only a small percentage of ancient life is preserved as fossils. It takes very special conditions for fossils to form.

Why Study Fossils?

Paleontologists are scientists who study fossils. By studying the remains of ancient living things and the rocks in which they are buried, paleontologists can learn about ancient organisms, where they lived, how many there were, and how they changed over thousands and millions of years. Paleontologists can also learn what their ancient environment was like and how climates have changed over millions of year. Paleontology is an exciting field of science!

When you complete the <u>Arizona's Prehistoric Past Lab</u> at the Desert Museum, you'll learn how fossils form and get to touch and examine all sorts of interesting fossils. Using these fossils, you'll figure out how different the Sonoran Desert was millions of years ago. You'll also find out what types of animals walked through your neighborhood a long time ago!

Brachiopoda



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