23C Sedimentary Rocks and Relative Dating

What can sedimentary rock tell us about its age?

Sedimentary rocks are formed from the compaction and cementation of separate particles called sediment. Sediment can consist of materials such as sand, clay, silt, pebbles, and gravel.

As time passes, sediment that is weathered from rock and/or eroded from the land gets deposited somewhere else. In certain environments, where weathering and erosion are slow, layers of sediment can build up faster than they are removed.

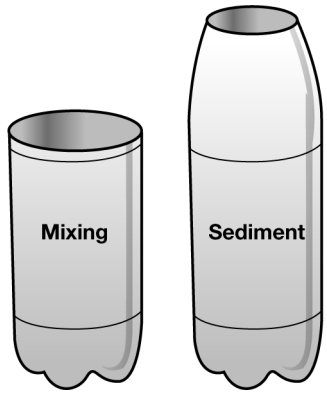
In this investigation, you will model the formation of sedimentary rock, observing how sediment size plays a part in its development, and gain an understanding of how scientists are able to place events in the sequence that they occurred, using these rock layers.

Materials

- Two 1-liter plastic soda bottles (labels removed)
- Scissors
- Permanent marker
- Soil mixture (one part topsoil to one part sand)
- Newspaper
- Beaker
- Metric ruler
- Spoon
- Sedimentary rock samples (sandstone, shale, conglomerate)

1 Setting up

1. Gather the items needed for this investigation. Cover your work area with newspaper. At the end of the investigation, you can wrap up the newspaper and throw it away to ease your clean-up.
2. Ask your teacher to make a slit in your first plastic bottle just below the bottle's shoulder. Then use your scissors to cut all the way around the bottle. You should have an open cylinder with straight sides. This bottle will be used for mixing.
3. Your teacher should make a slit in the second bottle just above the shoulder. Then use your scissors to cut all the way around this bottle. It will be used for holding your sediments. See the diagram to the right before you cut your bottles.



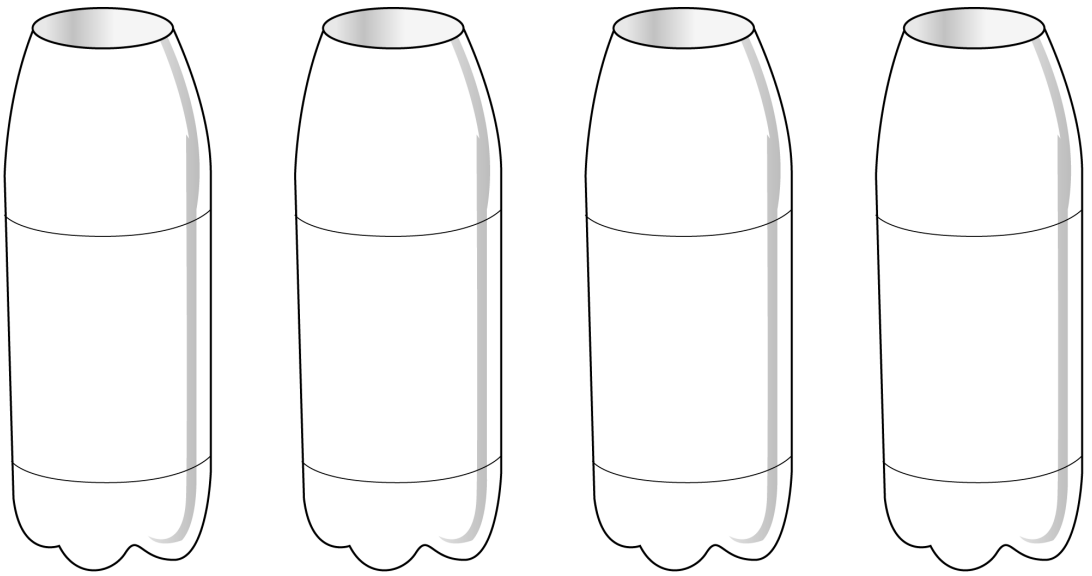
4. Label the first bottle “mixing” and the second bottle “sediment.”
5. Add water to the sediment bottle to a depth of five centimeters.
6. Add the soil mixture to the mixing bottle to a depth of three centimeters.
7. Add water carefully into the mixing bottle and mix it to make a “mud slurry.” Add just enough water to make it the thickness of a thick milk shake.
8. Pour your mud slurry into the sediment bottle and mix it into the water.
9. Allow the sediment bottle to stand undisturbed for two minutes or until you can see layers forming.

2 Stop and think

a. Once you see layers in the sediment bottle, make a sketch of the layers in the first bottle below, labeled "first slurry." Be sure to draw and label the following in your diagram: floating debris, fine particles, and coarse particles.

b. Where in your bottle did you find the coarsest sediment? Where is the finest sediment?

c. Is there a change in color from bottom to top? Explain why or why not?



First slurry Second slurry Third slurry Fourth slurry

3 Doing the experiment

1. Now you will be adding more sedimentary layers to your bottle. The procedure is slightly different than the first trial.
2. Examine the water level in your sediment bottle. You need only five centimeters of water over the settled slurry. Carefully pour off excess water into a wastewater container.

3. Add 1 centimeter of sediment to the mixing bottle. Then, add water until the new mud slurry is much thinner than the first slurry you made.
4. Have one of your team members continuously stir the slurry for twenty seconds. Do the next two steps quickly.
5. Pull your spoon through the water in the sediment bottle just over the surface of the settled slurry, a little off-center.
6. Immediately add the new slurry to the sediment bottle while the water is still swirling.
7. After two minutes, sketch the layers you see. Use the bottle diagram labeled "second slurry." Pay special attention to thickness, sediment size, and the angle in which layers formed (i.e. slanted, straight across, etc.).
8. Repeat steps 2 through 7 until you have added three slurries to the original for a total of four slurries added to the sediment bottle. Stop the process if your sediment bottle gets too full.

4 Thinking about what you observed

a. Wipe off the sides of your bottle. Carefully examine the sediment in your bottle. Is each slurry you made represented by a distinct layer? If so how many layers do you see?

b. Are the sedimentary layers in your bottle the same thickness?

c. Which size sediments settled into the bottle faster: larger or small particles? Explain your answer.

d. What will happen to your sedimentary layers when the water evaporates?

e. What kinds of environments would cause sediment layers to be deposited over time on top of each other?

5 Exploring further

a. Label the sedimentary layers in your sketch from oldest to youngest. How do you think geologists can figure out the age of sedimentary rock layers in areas such as the Grand Canyon?

b. Do you think the age of the sedimentary rock layers from the Grand Canyon that geologists figure out would be the relative age (the age in reference only to the other rock layers in the area) or absolute age (the exact age)?

c. What might be a way of figuring out the absolute, or exact age of the rock layers? Hint: what might be embedded in those sedimentary layers that the geologists could use to get an exact date?

6 Exploring on your own

a. Examine the sedimentary rock samples. Classify these sedimentary rocks according to color, texture, and particle size. What types of particles do you think make up each of the rock samples?

b. Based on the results of this investigation, where would you expect to find each of these sedimentary rock samples in a river system? Upstream near the source of the river or farther downstream near the mouth of the river?

c. Go for a "rock walk" around your school or around your home. See if you can find samples of sandstone, shale, or conglomerate in these areas. Collect any other rocks that may seem interesting to you as well. Take these rocks back to your classroom and classify them according to their color, texture, and mineral size.