

Activity 13: Mechanical Weathering

Maine Geological Survey



Objectives:

To give the students an opportunity to realize that all rocks weather mechanically and each specific rock type has its own particular rate of weathering.

Time:

This activity is designed to last approximately 45 minutes.

Background:

Mechanical weathering is the process of breaking down bedrock into smaller fragments by physical as opposed to chemical means. Rock weathering, although it seems to occur ever so slowly in human terms, is an extremely significant part of the rock cycle. Weathered rock materials are called sediments and are the structural basis for ALL the world's soils. Sediments can also be compacted into sedimentary rock.

Rock weathering rates vary widely depending on mineral content, texture, rock type, and climate. Differential weathering, varying weathering rates for two or more rock types in physical contact with each other, has given rise to some of the world's most breathtaking scenery such as the coastlines of Maine, New Brunswick, and Nova Scotia. The rock formations at Two Lights State Park, Cape Elizabeth, Maine are an excellent example.

Materials:

Students should work in groups of two. Each group will need the following:

- 1 lb. coffee can with plastic cover
- 250 ml beaker and access to water
- Stirring rod
- Sheet of white paper
- Balance
- 3 pieces of each of the following rock types - granite, sandstone, and white limestone (the kind sold in K-Mart is excellent). The rock types should be of more or less uniform size in the 1 x 2 inch range.

Procedure:

Each pair of students should abrade their samples by hand, in the can, and in water (see student sheet) and record the results. As time allows, other combinations such as granite - sandstone, limestone-sandstone, or granite-limestone may be tested.

Special Safety Procedures:

Teachers should check rock samples, especially the granite, for any very sharp edges and dull these with light taps from a hammer before the activity.

Follow-Up:

After discussion of the results of this activity, the following exercise will provide immediate reinforcement and local application of what the students have just learned. Select a local hill, mountain, or similar "upstanding" bedrock feature that has obviously resisted weathering quite well. Ask the students to PREDICT, based on their recent activity, of what rock type this local feature is made. Collect a sample from the feature, or have the class visit it if feasible, and see if the class predictions were correct. Davis Mountain in Lewiston, Bradbury Mountain in Pownal, and Streaked Mountain in Buckfield are good examples.

The problems of beach loss and weathering are also related to this topic. Teachers may wish to review the field trips to either Higgins Beach in Scarborough or Camp Ellis in Saco for an extension of this topic. See the CREST Field Trip Guide Book which was published in 1992.

References:

Activity adapted by Duane Leavitt from materials in the Earth Science Source Book, edited by John R. Carpenter (Center for Science Education, University of South Carolina, Columbia, South Carolina, 1987)

Name _____



Activity 13: Mechanical Weathering

Maine Geological Survey

Student Sheet

Purpose:

To understand how rocks are broken down mechanically and how different rock types are broken down at different rates.

Materials:

Coffee can with plastic lid (one pound can), a 250 ml beaker, stirring rod, 3 pieces each of granite, limestone, and sandstone, 100 ml of water, white paper, balance, notebook, and pen.

Procedure:

You are going to determine if all rocks weather (wear away) at the same rate. You will test each specific rock type in 3 different ways and record the results. Other combinations may be tested if time allows. If you do not recognize the three rock types be sure and get this information from your teacher.

Part I:

Take two pieces of rock of the same type and rub them together with your hands as hard as you can over the white paper. Do not bang the rocks together from a distance. Repeat with the samples of the other two rock types. Record your observations. How easily does the rock disintegrate? What is the appearance and relative amount of the material that accumulates on the paper?

Granite:

Sandstone:

Limestone:

Part II:

Record the initial weight of each rock type (A) in the table below. For each rock type, place all three pieces of the rock in the coffee can, snap on the lid, and shake vigorously for 3 minutes. Be sure to hold the lid firmly in place. At the end of 3 minutes, pour out ALL of the contents onto the white paper.

Any pieces of rock LARGER than the dot at right should be collected into a pile and weighed. Record this weight (B). ●

Subtract B from A to obtain the weight of the small particles (C). Divide C by the total weight A to obtain an indication of the relative resistance of each rock type to erosion (D). The smaller the value for D, the more resistant the rock is to mechanical abrasion.

		Granite	Limestone	Sandstone
A	Initial Weight			
B	Weight of large particles			
C	Weight of small particles			
D	% Small particles			

Part III:

Using the smaller materials left over from Part 2, place these in the 250 ml beaker with 100 ml of water and stir GENTLY for a minute. Record the color of the water at the end of this time as well as the nature of the residue, if any, on the bottom of the beaker.

		Granite	Limestone	Sandstone
A	Water Color			
B	Nature of Residue			

Questions:

1. List one natural condition or situation that is similar to each process used in the lab.
2. Did all the rock types weather at the same rate? If not rank order them from fastest to slowest.
 - 1.
 - 2.
 - 3.
3. Both sandstone and granite contain large amounts of quartz and yet there was a considerable difference in how these two weathered; what might be the cause of this?
4. Of the three rock types tested, which type do you think would most often form hills, ridges, and mountains? Explain your choice.
5. Crushed rock is used extensively in the state of Maine (for example, Crooker Paving of Topsham). List several uses of crushed rock. Explain why certain rock types are more desirable than others.