Weathering and Erosion

Grade Level: 6th
Jonathan Nycz
4 November 2010

Content Standards:
Soils E.SE.06.11
Explain how physical and chemical weathering lead to erosion and the formation of soils and sediments.

Soils E.SE.06.12
Students will be able to explain how waves, wind, water and glacier movement shapes and reshaped the land surface of the Earth by eroding rock in some areas and depositing sediments in other areas.

Objectives:
Learners will be better able to identify how weathering breaks down rock into smaller pieces. Learners will be better able to explain the different processes of erosion. Learners will be better able to explain the difference between erosion and weathering.

Materials needed:
1. Pencils
2. Shallow plastic bins
3. Small, clear containers
4. Clean sand (e.g. play sand)
5. Gravel
6. Chalk
7. Plaster of paris
8. Water
9. White vinegar
10. Sandpaper
11. Rock samples
12. Freezer
13. Ice cube trays

Materials for optional extensions:
1. Bean seeds
2. Potting soil
3. Granulated sugar

Background information:
This lesson is adapted from information and activities at the following sites:
http://geologyonline.museum.state.il.us/tools/lessons/6.3/lesson.html
http://igs.indiana.edu/geology/rocks/rockcycleactivities/weathering.cfm

See also background information at: http://teach.albion.edu/jjn10

Instruction:

1. Begin by having a discussion with students about various landforms with which they may be familiar: hills, lakes, rivers, etc. Ask if anyone has ever given any thought to how these features develop and change over time.
2. Ask if the students have ever heard the terms *weathering* or *erosion*. If so, have the students explain in their own words what these words mean.
3. Discuss the differences between physical and chemical weathering, and between weathering and erosion.
4. For many of the different types of weathering and erosion, we often can't tell the process is happening. Why is this? (The physical scale involved, the length of time for many of these processes, etc.)
5. Explain that the students are going to investigate different types of weathering and erosion, making observations, inferences, and asking questions.
6. Having prepared the activity stations ahead of time, allow the students to work in small groups at each station so that every student is able to spend time at each station. This may work better is spread over the course of several days with only part of the class investigating the stations on each day.
7. After the students have all had a chance to examine the different processes, have a class discussion about their findings, observations, hypotheses, and any questions they may have.
8. Make a note to integrate the findings from *Erosion/Rock hardness* into the overall discussion. How is the action of sandpaper on the rock similar to sand grains being blown into rock by the wind? How is it different?
9. Similarly, integrate the findings from *Abrasion* into the discussion of stream, glacier, and wave erosion. Will we see different results of these processes depending on how soft a substance is (e.g. stream erosion through soil, a soft rock, a hard rock)?
10. As a short follow-up, have the students complete a short worksheet reinforcing the differences and similarities between erosion and weathering.

Activity station 1: Mechanical/physical weathering

1. Using the bottom of a milk carton, or a similar container, prepare several blocks of plaster of paris about 3" x 3" X 3". Before the plaster sets, use a utensil to score a narrow groove through the block (without continuing the groove to the edges of the block).
2. Once the plaster is dry, remove each block from the container and have each group of student measure the length and width of the crack in their block.
3. Fill the groove in each block with water and place in the freezer.
4. Once the water has frozen, remove from the freezer and measure the crack again. Allow the water to melt completely before placing back in the freezer.
5. Complete this cycle over several days (possibly leaving the blocks in the freezer each night and recording data at some point during the day).
6. Have the students keep track of daily measurements. How long did it take until the crack was larger? Is there anything else the students noticed? Did the block ever break completely? After how many days?

Activity station 2: Chemical weathering

1. Have students place a small amount of white vinegar into a small, clear container.
2. Examine what happens to a piece of chalk when it is placed into the vinegar. Have students record their immediate observations, after 10 minutes, and a day later.
3. What has happened to the chalk? How is this type of weathering different from mechanical/physical weathering?

4. If possible, students may experiment further. Is there a difference if the chalk is broken into several pieces and then placed into the vinegar versus a whole piece of chalk? Why might this be?
5. What might happen when water flows over or through rock containing similar minerals (to the chalk)?

Activity station 3: Erosion/Rock hardness

1. Have students examine several different rock samples.
2. Each student should note what the rock looks like: color, shape, etc.
3. Encourage students to think about the strength and hardness of different rocks. Can it be scratched by a fingernail, a penny?
4. What happens when each sample is rubbed with different types of sandpaper?
5. What happens when you rub the rock with your fingers?
6. Why might a feature such as how hard a rock is be important in discussing weathering and erosion?

Activity station 4: Glaciers

1. Pile a mound of sand into one of the shallow bins.
2. Provide an ice cube tray filled with ice cubes- some just water, some with gravel and sand frozen in them.
3. Place the ice cubes near the top and record what happens as they start to melt.
4. If you gently push the ice cube down the mound (not down into the sand) what happens to the material?
5. Have students record observations for both the moving glacier and a melting glacier with particles frozen in it. Where are these particles once the glacier is gone?

Activity station 5: Waves

1. In one end of a shallow bin, place a low mound of sand.
2. Fill the bin with water so that it comes about halfway up the mound of sand.
3. Have students gently rock the bin up and down (pivoting on one of the bottom edges of the bin) so that gentle wave-motions are created.
4. What happens to the sand that comprises the beach? Does this sand remain in place?
5. What happens if the waves are larger, more violent, etc?
6. Add some gravel to this mix. Record your observations.
7. Is there a difference between the effect of the water on the gravel and the effect of the water on the sand?

Activity station 6: Wind

1. Place a layer of sand in one of the shallow bins.
2. Place an electric fan or hairdryer at one end.
3. How does the sand respond to the wind?
4. Is there any change when the fan or hairdryer is one a higher setting (i.e. a stronger wind)?
5. Add some gravel to the sand. Is the effect of the wind on the gravel the same as the effect on the sand? If not, why might this be?

Activity station 7: Streams

1. Based on the audio-visual equipment available to the teacher, this station may be better completed as a whole class.

2. Have the students watch each of the short videos of the stream table.
3. For each video, have students answer a few short questions. Encourage them to include any questions or miscellaneous observations.

Activity station 8: **Abrasion**

1. Fill a small, watertight container with water, sand, some gravel and a rock sample.
2. Fill a small, watertight container with water, sand, some gravel, and a piece of chalk.
3. Have students record initial observations (including the weight of the rock sample).
4. Shake each container 200 times.
5. Observe the rock sample and the piece of chalk. Are there any differences? Record the observations.
6. Shake each container another 200 times. Observe and record again.
7. Shake each container another 200 times. Observe and record again.
8. How is this like the action of sand, gravel and rocks grinding and colliding in streams, rivers, or waves? How is this different?
9. Why do you think we see different results between the chalk and the rock sample?
10. How would you devise a method for determining if the rock sample ever starts to break down?

Possible extensions:

1. Take a field trip to an area in which students may observe streams, erosion, root wedging, etc. firsthand. Have the students record their observations and any questions they have.
2. If there is space in the classroom, the optional root wedging activity station may be included.
3. It may be difficult for students to conceptualize deposition related to materials in solution. An optional activity station can be included if needed.

Optional activity station 1

1. Prepare plaster of paris in several small containers.
2. Before the plaster sets, create deep, thin grooves in the plaster.
3. Cover the plaster with several inches of soil.
4. Using a pencil/finger/etc. poke a few holes into the soil and insert soaked bean seeds so that they are at a depth of approximately 1-1.5 inches.
5. Keep the soil moist until the beans sprout and water as necessary.
6. Allow these plants to grow for as long as possible before examining what has happened to the underlying plaster.

Optional activity station 2

1. Have students dissolve granulated sugar in warm water.
2. Allow this water to sit undisturbed and uncovered so that the water can fully evaporate.
3. What is left behind?

Assessment:

Assessment will occur through observations, the group discussion, student notes and worksheets.

Evaluation:

I will know that learners are better able to identify how weathering breaks down rock into smaller pieces by having them share their ideas with others/the class. I will know that learners are better able to

explain the different processes of erosion by conferencing with them at the activity stations. I will know that learners are better able to explain the difference between erosion and weathering by examining their responses to a short post-lesson worksheet.