The Wonder of Weathering

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Time:
45 minutes in the classroom
45 minute field experience

Level:
Grades 4-5
Standards selected for grade 4 and 5

Goals:
Students will participate in a hands-on exploration activity to help them better understand the basic properties of rocks and the processes involved in the formation of soils. Their learning will specifically focus on weathering and erosion.

Objectives:
1. When asked by a partner, students will be able to define what the words 'weathering' and 'erosion' mean in a science context with 90% accuracy.

2. Using the background evidence from the lab they completed, students will be able to explain in their own words how the processes of weathering and erosion change and move materials that become soil in three or more complete sentences.

Materials listed with each individual lesson plan.

A materials kit is available for this lesson plan on www.utahnatureexplorers.org

Correlations to Core Curriculum:
Fourth Grade

- Standard 3: Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.
    - Objective 2: Explain how the processes of weathering and erosion change and move materials thatbecome soil.
        - Indicator b: Distinguish between weathering (i.e., wearing down and breaking of rock surfaces) and erosion (i.e., the movement of materials).

Fifth Grade

- Standard 2: Students will understand that volcanoes, earthquakes, uplift, weathering, and erosion reshape Earth's surface.
    - Objective 1: Describe how weathering and erosion change Earth's surface.
        - Indicator a: Identify the objects, processes, or forces that weather and erode Earth's surface (e.g., ice, plants, animals, abrasion, gravity, water, wind).

Background Information:

Weathering and Erosion

Weathering is the breaking down or dissolving of rocks and minerals on Earth's surface. Water, ice, acids, salt, plants, animals, and changes in temperature are all agents of weathering. Once the rock has been broken down, a process called *erosion* transports the bits of rock and minerals away. No rock on Earth's surface is hard enough to resist weathering. Weathering and erosion constantly change the Earth. Weathering wears away exposed surfaces over time. The process of weathering smoothes sharp, rough areas on rocks. Weathering also helps create soil as tiny bits of weathered rock mix with plant and animal remains.

The process of erosion moves bits of rock or soil from one place to another. Most erosion is performed by water, wind, or ice (usually

in the form of a glacier). These forces carry the rocks and soil from the places where they were weathered. If water is muddy, it is a sign that erosion is taking place. The brown color indicates that bits of rock and soil are suspended in the water and being transported from one place to another. This transported material is called sediment.

http://education.nationalgeographic.com/education/encyclopedia/weathering

Types of Weathering

Weathering can be a mechanical or a chemical process. Often, these two types of weathering work together.

Chemical weathering changes the materials that make up rocks and soil. Sometimes, carbon dioxide from the air or soil combines with water. This produces a weak acid, called carbonic acid, which can dissolve rock. Carbonic acid is especially effective at dissolving limestone. When the carbonic acid seeps through limestone underground, it can open up huge cracks or hollow out vast networks of caves. Another type of chemical weathering works on rocks that contain iron. These rocks rust in a process called oxidation. As the rust expands, it weakens the rock and helps break it apart.

http://education.nationalgeographic.com/education/encyclopedia/weathering

Mechanical weathering takes place when rocks are broken down without any change in the chemical nature of the rocks. The rocks are essentially torn apart by physical force, rather than by chemical breakdown. The most common type of mechanical weathering is the constant freezing, and thawing of water. In liquid form, water is able to penetrate the many holes, joints, and fissures within a rock. As the temperature drops below 32° F, this water freezes. As water freezes, it expands, becoming about 10% larger than it was in liquid form. The result is that the holes and cracks in rocks are pushed outward. Even the strongest rocks are no match for this force. Another important type of mechanical weathering is salt wedging. As water enters the holes and cracks in the surface of rocks, it often carries salt with it. As the water later evaporates, the salt is left behind. Over time, these salt deposits build up, creating pressure that can cause rocks to split and weaken.

http://www.kidsgeo.com/geology-for-kids/0066-mechanical-weathering.php

Types of Erosion

Moving water is the major agent of erosion. Rain carries away bits of soil and slowly washes away rock fragments. Rushing streams and rivers wear away their banks, creating larger and larger valleys.

Did you know?

Landscape Arch, at 88 meters (289 feet), is the longest natural arch in Arches National Park, Utah. Many geologists believe Landscape Arch is the longest natural arch in the world. Like all natural arches, Landscape Arch was formed by the processes of weathering and erosion.

www.education.nationalgeographic.com

Erosion by water changes the shape of coastlines. Waves constantly crash against shores. They pound rocks into pebbles and reduce pebbles to sand. Water sometimes takes sand away from beaches. This moves the coastline farther inland.

Wind is also an agent of erosion. It carries dust, sand, and volcanic ash from one place to another. Wind can sometimes blow sand into towering dunes. In dry areas, windblown sand blasts against rock with tremendous force, slowly wearing away the soft rock. It also polishes rocks and cliffs until they are smooth.

Ice can erode the land. In frigid areas and on some mountaintops, glaciers move slowly downhill and across the land. As they move, they pick up everything in their path, from tiny grains of sand to huge boulders. The rocks carried by a glacier rub against the ground below, eroding both the ground and the rocks. Glaciers grind up rocks and scrape away the soil. Moving glaciers gouge out basins and form steep-sided mountain valleys.

Erosion is a natural process, but human activity can make it happen more quickly. Trees and plants hold soil in place. When people cut down forests or plow up grasses for agriculture or development, the soil washes or blows away more easily. Landslides become more common. Water also rushes over exposed soil rather than soaking into it, causing flooding.

http://education.nationalgeographic.com/education/encyclopedia/erosion

Did you know?

The word erosion comes from the Latin word "erosionem" which means "a gnawing away."

http://www.ducksters.com/science/earth_science/erosion

Lessons and Activities:

Materials available in a kit are italicized in the list below

Materials:

Supplies:

- Science journals and pencils for each student
- *30-45 sugar cubes*
- Chart paper or Document Camera
- *KWL paper for each student (attached at the end of the lesson plan)*

Equipment:

- *10-15 small plastic containers (with lids)*
- *10-15 sets of 3 types of rocks (pebbles,*

Day 1 (Classroom) --

Engage (10 minutes) – Show students a variety of pictures of nature in which weathering and/or erosion took place. *(You can download the 'Weathering and Erosion Pictures' PDF for some great examples of weathering and erosion in Utah.)* Ask the students if they recognize any of the places in the pictures, and if not, identify and name each of the pictures' locations. Ask the students how they think each of these natural formations was formed. Allow students to give a few ideas before telling them that they were formed by the processes of weathering and erosion.

Give each student a personal 'KWL' chart (attached at the end of the document). Ask them to write what they already know about weathering and erosion, as well as what they want to know about weathering and erosion. Ask them to leave the 'L' section blank for the time being. If English Language Learners or struggling learners are present, you may want to accommodate for their needs by

sand, pea gravel, things that are small in size)

- *Weathering/Erosion Pictures PDF (download at www.utahnatureexplorers.org)*

allowing them to draw what they know and want to know. Tell students that they need at least 3 statements/drawings in each category.

After giving students 3-5 minutes to work on their KWL chart, ask students to share what they wrote down or drew with the class. Record a few of the shared statements on the class 'KWL' chart, which should be on chart paper attached to the whiteboard or shown under a document camera. Do not correct any misconceptions immediately, but be sure to address them within the 'explore' or 'explain' sections.

Explore (20 minutes) -- In pairs or small groups (no more than 4 people), do the following activities:

- Give each pair/small group a small plastic container (including the lid) and a set of 3 types of rocks. Identify and name the types of rocks for the students so that they can be more clear and descriptive as they write notes in their science journals. Give each group 3 sugar cubes, and instruct the students not to touch them before beginning their experiment, as this could cause extra weathering or erosion.
- Ask each student to pull out their science journal and a pencil. Explain that they will be making detailed scientific observations and drawings as they participate in a 'weathering and erosion' experiment today.
- Ask each group to decide which type of rock they would like to test first. Once they have decided which type they will be testing, ask them to write the name of that rock in their science journal, leaving room below for predictions, observations, and results. *(You may also choose to have all students test the same rocks at the same time. This will make your lesson more teacher directed.)*
- Have students place the sugar cube in the plastic container, add rocks to the jar, and put the lid on tight. Have the students predict and write in their journals what the sugar cube will look like after they have shaken the plastic container for two minutes. They could write their prediction, or make a detailed scientific drawing. (Many students may believe that the sugar cube will be completely gone and changed into small particles of sugar after two minutes.)
- Set a class timer for two minutes, and have the students begin shaking their bottles. Ensure that students are shaking the bottles appropriately for the activity, and not trying to break the bottles with the rocks inside. Students may want

Did you know?

The Appalachian Mountains in eastern North America once towered more than 9,000 meters (30,000 feet) high—taller than Mount Everest! Over millions of years, weathering and erosion have worn them down. Today, the highest Appalachian peak reaches just 2,037 meters (6,684 feet) high.

http://education.nationalgeographic.com/education/encyclopedia/weathering

to switch off shaking the bottle if they get tired of shaking it. *(You may want to give a demonstration of how to appropriately shake the jar before allowing students to begin.)*

- When the two minutes are over, have the students observe the sugar cube and record their observation in their journals. Do this activity three times, each time with a different rock type, and each time having them predict what they think the sugar cube will look like after the two minutes of shaking. Have them record the data in their journals.

Explain (8 minutes) – Discuss what each group's sugar cubes looked like after the three different sessions. Talk about how different sized gravel affects the erosion of the sugar cube (i.e. bigger pebbles break the cube up faster than smaller pebbles). Talk about what results were expected, and what surprised the students. Allow the students to explain how this experiment relates to weathering and erosion in nature. Address and discuss as a class earlier misconceptions. Correct the misconceptions, and allow the students to explain why the misconceptions were false.

Elaborate (7 minutes) – Ask students to fill out their 'L' section on their KWL chart. Remind students to write down at least 3 statements in the 'Learned' category in order to get full points on the KWL chart. If time permits, ask students to share what they have learned, and write those things down on the class 'KWL' chart. Have students turn in their KWL charts for assessment purposes. After assessing, return these charts to the students to keep in their science journals.

Day 2 (45 minute Field Experience) –

Materials:

Supplies –

- Science journals
- Pencils

Equipment--

- Nearby stream/area to observe weathering and erosion

Take students to a nearby stream or river. Examine different areas of the stream and show the students how the size of rocks deposited in various areas of the stream is determined by both the area of the steam and the speed of the stream.

Fast moving areas will have bigger rocks, slower moving areas will have smaller rocks. When you get to the end of the river, the deposits are more sediments than rocks.

Allow students to explore different areas of the stream, and ask them to make at least 5 detailed scientific observations or drawings.

Before leaving the stream or river, sit together as a class and talk

about the observations that were made that day. Take time to talk about what they saw that was affected by weathering and/or erosion. Address questions, if needed. Ask students to talk in small groups about how the experiment they did with sugar cubes was similar to what they saw in the stream. Take some time to discuss as a whole class the connections that were found between their in-class experiment and their field experience.

Assessment:
KWL charts should be assessed. Students should be made aware of the requirements to get full points before making their KWL charts. This should not be used as a final assessment for the unit, but rather, should inform instruction of the teacher, and should make the teacher aware of student misconceptions. This experience will allow the teacher to determine if objectives and goals for the day were met. If desired, the science journals could be collected after the field experience to get a better idea of the students' understandings of weathering and erosion. The rubric at the end of this document is set up to assess the KWL charts.

Extensions:

- Art – Have the students draw the sugar cubes after each shaking time frame.
- Math – Have the students measure with the sugar cube with calipers before and after each shaking and graph their findings.
- Language Arts- Have the students write in their journals why or why not their predictions were correct, and what they discovered by doing this experiment.

Resources:

Books

- *Utah Master Naturalist Mountains Textbook* *http://extension.usu.edu/utahmasternaturalist/files/uploads/UMNP_Mountains_Text.pdf*
- *Utah Master Naturalist Deserts Textbook* *http://extension.usu.edu/utahmasternaturalist/files/uploads/UMNP_Deserts_Text.pdf*
- *Utah Master Naturalist Watersheds Textbook* *http://extension.usu.edu/utahmasternaturalist/files/uploads/UMNP_Watersheds_Text.pdf*
- *Weathering and Erosion* by Clive Gifford
- *Shaping the Earth: Erosion* by Sandra Downs

- *The Disappearing Mountain and Other Earth Mysteries: Weathering and Erosion* by Louise and Richard Spilsbury

Websites

- National Geographic http://education.nationalgeographic.com/education/encyclopedia/erosion
- GREAT video and short quiz for kids on Scholastic -- http://studyjams.scholastic.com/studyjams/jams/science/rocks-minerals-landforms/weathering-and-erosion.htm
- Geology for Kids http://www.kidsgeo.com/geology-for-kids/0059-introduction-to-erosion.php
- Ducksters http://www.ducksters.com/science/earth_science/erosion

KWL Chart Rubric

There are at least three statements in each category – K, W, and L *(12 points)*	There are at least two statements in each category – K, W, and L *(8 points)*	There is at least one statements in each category – K, W, and L *(4 points)*	There are no statements made on the KWL chart *(0 points)*

Student Name:

Points: /12

Name_____
Date_____

Weathering and Erosion KWL

What I already know:	What I want to know:	What I learned: