

Surface Changes

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Science Content Standards: Grade 4, 5a — *Students know* some changes in the earth are due to slow processes, such as erosion, and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes; 5b — *Students know* natural processes, including freezing and thawing and the growth of roots, cause rocks to break down into smaller pieces; and, 5c *Students know* moving water erodes landforms, reshaping the land by taking it away from some places and depositing it as pebbles, sand, silt, and mud in other places (weathering, transport, and deposition).

Lesson Concept: Weathering, erosion, and deposition are usually slow changes.

Conceptual Flow:

- » Weathering, erosion, and deposition are usually slow changes.
 - Weathering is the process by which rocks are broken down into smaller pieces.
 - There is physical and chemical weathering of rocks.
 - Erosion is the movement of sediment from one place to another.
 - Erosion can be caused by wind, water, glaciers, living things, and gravity.
 - Deposition is the laying down of soil and pieces of rock.
 - A delta is formed as a result of deposition.
- » Weathering, erosion, and deposition change the way the Earth looks.
 - Once the land on the Earth is changed, humans have to adapt to these new changes.
 - Erosion can make a road slip, so it must be fixed in order to continue using it safely.
 - Weathering, erosion, and deposition can move pieces of a big rock from the mountains down to the ocean and some of the rock breaks down to grains of sand.

Teacher Background:

Weathering is the breaking down of rocks and may be caused by chemical or physical means. Weathering produces pebbles, sand, silt, and mud. Chemical weathering occurs when atmospheric components (e.g., oxygen, carbon dioxide, and water) interact with Earth's surface materials and cause them to break apart or dissolve. Physical processes, such as alternate freezing and thawing of water, exfoliation, or abrasion, may also contribute to the weathering process. Plants may promote

weathering as their roots expand in cracks to break rocks. Weathering results in the formation of soil or sediment.

Erosion is the movement of sediment from one place to another and may be caused by wind, water, glaciers, living things, and gravity. Erosion may occur so slowly that careful measurements are necessary to establish that a change is taking place. However, landslides may take place very rapidly.

Deposition is the laying down of soil and pieces of rock. After earth materials have weathered (broken down) and been transported (eroded), they are deposited in a new location. Erosion moves the products of weathering from one place to another. As erosion transports the broken and dissolved products of weathering, it alters the shape of landforms.

The most important agent of transportation is water. Water flowing in streams can be energetic enough to pick up and carry silt, mud, sand, and pebbles. Even boulders can be moved by water during floods. Flowing water reshapes the land by removing material from one place and depositing it to another place. (Adapted from and excerpted from the *Science Framework for California Public Schools: Kindergarten Through Grade Twelve*.)

Materials Needed for the Lesson:

Teacher Materials

- A picture of a rock arch in the ocean (check Science textbooks for pictures)
- A picture of the river with all the deposition at the end (check Science textbooks for pictures)
- Bottle of water (quart)
- Stream table (plastic “sweater” box approximately 16 inches wide, 30 inches long, and 6 inches deep)
- Sand (4 cups) (purchase playground sand from a home improvement store)
- OPTIONAL: A video that shows erosion

Student Hands-on Materials

- Each of the three groups of up to 10 students should receive one clear plastic jar with lid and one of the following:
 - Group #1 has rocks only (use broken pieces of red brick or from a clay pot)
 - Group #2 has rocks and water
 - Group #3 has rocks and sand (use broken rocks/bricks)
- Bottle of water (quart) for each group
- Stream table with 4 cups of sand (plastic “sweater” box approximately 16 inches wide, 30 inches long, and 6 inches deep) for each group

Student Handouts

- “Weathering, Erosion, and Deposition Investigation Data Sheet” (2 pages)

5E Lesson: Surface Changes

Teacher Does	Student Does	Concept
<p><u>ENGAGE:</u></p> <p>Show a picture of the arch rock in the ocean and the picture of the river with all the deposition at the end.</p> <p>Point to the arch:</p> <ul style="list-style-type: none"> ▶ <i>This was once a solid piece of rock. What could have caused the hole in the rock? Discuss with a partner about how this hole got there.</i> ▶ <i>Now look at this picture of the river: Where do you think all this stuff here at the end came from?</i> <p>Record student responses on the board or chart paper.</p> <ul style="list-style-type: none"> ▶ <i>Do you think these changes happened quickly or took a long time?</i> ▶ <i>Today we are going to be doing some investigations that may help us to understand how these changes happened.</i> 	<p>Look at the pictures. Discuss with a partner about how these changes could have happened.</p> <p>Expected Student Response (ESR): A rock rolled down a hill and hit it and made the hole; a big wave knocked a hole in it.</p> <p>ESR: A lot of rain came and it got really wet and it slid down;</p> <p>ESR: They took a really long time.</p>	
<p><u>EXPLORE:</u></p> <ul style="list-style-type: none"> ▶ <i>We will begin our investigations by observing some processes that can change rocks.</i> <p>Distribute the “Weathering, Erosion, and Deposition Investigation Data Sheet”.</p> <ul style="list-style-type: none"> ▶ <i>It is important that as a scientist you take careful and accurate observations and record them, because you will use your observations, which will be your data, to answer your final question. So be accurate!</i> ▶ <i>Your first investigation will be studying ways rocks can change and what changes them. There will be three jars with rocks. The jars</i> 	<p>Put name on paper.</p>	<p>Weathering is the process by which rocks are broken down into smaller pieces.</p> <p>Erosion is the movement of sediment from one place to another.</p> <p>Deposition is the laying down of soil and pieces of rock.</p>

Teacher Does	Student Does	Concept
<p><i>are numbered 1, 2, and 3. Look at your “Weathering, Erosion, and Deposition Investigation Data Sheet”. You will record the number of the jar that your group is given. Next, write down the contents of your jar (#1 has rocks only, #2 has rocks and water, #3 has rocks and sand). After you complete the activity, you will describe the rocks.</i></p> <p>Distribute the rocks and have students complete what has just been explained. (5 minutes maximum for writing and sharing)</p> <ul style="list-style-type: none"> ▶ Someone, please share your description of the red rocks. <p>(Have a couple of students share, so that you get that there are sharp, jagged edges on the red rocks.)</p> <ul style="list-style-type: none"> ▶ <i>Now you will shake your jars. Each person in your group will get 10 shakes. With 10 people, how many total shakes total will that be?</i> <p>(If there are not 10 people in the group, figure out how many shakes for each so that each jar is shaken 100 times).</p> <ul style="list-style-type: none"> ▶ <i>Then go around a second time so each jar has been shaken 200 times. Everyone else in the group is to count. Make sure the counting stays with the number of shakes!!!!</i> ▶ <i>Now record what the rocks look like after the 200 shakes.</i> ▶ <i>What do the rocks look like after the shaking? Jar #1? Jar #2? Jar #3?</i> ▶ <i>From your activity, how can big rocks become smaller rocks?</i> ▶ <i>Next to the word “Weathering”, write the definition of weathering which is:</i> <p>(Write on the board)</p> <ul style="list-style-type: none"> ▶ <i>“the process by which rocks are broken down into smaller pieces.”</i> ▶ <i>Now you will move to the second investigation where you will observe how water can change the land and the shape of a river. We will look at the process of erosion. (Move to the stream tables).</i> 	<p>Record the jar number, the contents, and the description of the red rocks.</p> <p>ESR: The rocks are red, have holes, have sharp edges.</p> <p>ESR: 100</p> <p>Shake jars 100 times.</p> <p>Record the looks of the rocks.</p> <p>ESR: The edges have been broken off and are more rounded.</p> <p>ESR: By bumping and hitting each other, pieces fall off and those pieces get more broken and become smaller.</p> <p>Write the definition of weathering.</p>	

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<p>▶ <i>Here you have a hill with a small river. You will observe how the flowing water of the river changes the sides of and possibly the shape of the river.</i></p> <p>Demonstrate how to set up the bottle of water and release the water.</p> <p>▶ <i>Look at the questions: “How has the river changed”? and “What happened at the end of the river?” Carefully observe so you can accurately answer the questions.</i></p> <p>Distribute the bottles of water to the groups to do the investigation. Teacher pours water into the cups. Allow 5-7 minutes to release the water and write observations (answer the 2 questions).</p> <p>▶ <i>How did the river change?</i></p> <p>▶ <i>Materials, like rocks and soil (which is simulated by sand in our models) moved down the river with the water; that is called erosion. By the word “Erosion” write the definition</i></p> <p>(Write on the board)</p> <p>▶ <i>the movement of sediment from one place to another.</i></p> <p>Clarify to students that sediment is all the material (rocks, boulders, sand, silt, twigs) that is moved by the water.</p> <p>▶ <i>What happened at the end of the river?</i></p> <p>▶ <i>The sediment that is moved to another place is called deposition. Next to the word deposition write: the laying down of soil and pieces of rock.</i></p> <p>If available, show a video that presents examples of erosion.</p>	<p>Release the water and observe. Answer the questions.</p> <p>ESR: The river got deeper; the sides broke away and flowed down; the river became less windy and became more straight.</p> <p>Write the definition of Erosion</p> <p>ESR: the sand piled up at the end of the river; the sand spread out at the end of the river.</p> <p>Write the definition of deposition.</p>	
<p><u>EXPLAIN:</u></p> <p>▶ <i>Let’s go back to the rocks in the jar/container. What natural processes are we simulating in Jar #1 (rocks with no water)?</i></p> <p>▶ <i>What about jar #2 (rocks with water)?</i></p> <p>▶ <i>What about jar #3 (rocks with sand)?</i></p>	<p>ESR: Rocks hitting each other rolling down a hill, like in a landslide.</p> <p>ESR: Rocks rolling down a river</p> <p>ESR: Rocks rolling down a hill and sliding on soil.</p>	<p>Weathering, erosion, and deposition can move pieces of a big rock from the mountains down to the ocean and some of the rock breaks down to grains of sand.</p>

Teacher Does	Student Does	Concept
<ul style="list-style-type: none"> ▶ <i>So now what about the water going down the river? Where would we see something like that in real life?</i> ▶ <i>Look at page 2 of your paper. Using the data you have recorded from your investigation, write a story explaining how a boulder in the mountains might end up being small grains of sand at the beach.</i> <p>Evaluation: After students complete their writing, ask:</p> <ul style="list-style-type: none"> ▶ <i>What is the order of the processes that occur from a boulder on a mountain to grains of sand on a beach located downriver?</i> 	<p>ESR: When it rains heavy, the water goes down the stream and carries rocks and sand. When there is too much water it takes the side of the river.</p> <p>ESR: A big rock is in the mountains. A big rain comes and the water moves the big rock down the mountain. As it rolls, pieces are broken off. The pieces are tumbled and broken and get smaller and smaller. They keep moving down the mountain in the river. After a long time the pieces move down to the ocean and are part of the sand on the beach.</p> <p>ESR: weathering, erosion, deposition</p>	
<p><u>EXTEND:</u></p> <ul style="list-style-type: none"> ▶ <i>Look for areas that have been weathered on your way to or from school and report back to the class. Draw or take a picture of the area.</i> 		

Input Question: What happened at the end of the river? (in Explore section)

Process Question: What natural processes are we simulating in Jar #1 (rocks with no water)? (in Explain section)

Output Question: Do you think these changes happened quickly or took a long time? (in Engage section)

STUDENT HANDOUT

**Weathering, Erosion, and Deposition
Investigation Data Sheet**

Investigation #1

Weathering: (definition) _____

Jar # _____ Contents: _____

Describe the rocks before they are shaken in a jar (are any jagged or smooth?)

How have the rocks changed? _____

Investigation #2

Erosion: (definition) _____

How has the river changed? _____

What do you see at the end of the river? _____

Deposition: (definition) _____

