

Earth's Changing Surface

Lesson 5: Weathering

Grade: 4	Length of lesson: 88 minutes	Placement of lesson: 5 of 6 lessons
Anchoring Phenomenon: The Mississippi delta has grown over thousands of years.		
Unit Learning Goal: At any given point in time, Earth's surface is both building up and wearing down. Some processes build up Earth's surface, while other processes wear down Earth's surface. These processes include weathering, erosion, and deposition and cause Earth's surface to look different in different places.		
<p>Lesson Main Learning Goal: Weathering is a process that changes Earth's surface by causing rock to fragment, crack, and crumble into smaller pieces. As rock and soil interact with water (rain, waves, ice), wind, or plants, they break apart into smaller pieces over time. Weathering and erosion are ongoing processes.</p> <p>Science and Engineering Practices</p> <p>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> • Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation. <p>Constructing Explanations</p> <ul style="list-style-type: none"> • Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation. <p>Crosscutting Concepts</p> <p>Cause and Effect</p> <ul style="list-style-type: none"> • Cause and effect relationships are routinely identified, tested, and used to explain change. <p>Stability and Change</p> <ul style="list-style-type: none"> • Some systems appear stable, but over long periods of time will eventually change. <p>Systems and System Models</p> <ul style="list-style-type: none"> • A system can be described in terms of its components and their interactions. 		
Unit Central Question: What can cause Earth's surface to look the way it does?		Lesson Focus Questions: Where does the soil and rock in a delta come from, and where does it go? Does the rock and soil ever change?
Science content storyline: Smaller rocks were once part of bigger rocks. Rock breaks down all over the land because of rain, ice, vegetation, and wind. Weathering is a set of processes that cause rock to break into smaller and smaller pieces. Rocks that are carried away due to erosion previously came from bigger rocks. Rock and other weathered materials are transported between different land and water features. As rocks continue to be carried away (erosion) by gravity, water, and/or wind, the rocks continue to break down into smaller pieces (weathering). These smaller pieces can be deposited in different places, building up the surface of Earth.		
Ideal student response to the Lesson Focus Questions: The Mississippi delta looks the way it does because rocks and soil are carried into the delta building up the land. This soil and rock originally came from bigger rocks. Different things can break rock into smaller pieces. Roots from growing plants get into cracks in rock and push the rock apart. Water gets into cracks in rock and expands when it freezes, making the crack get bigger and eventually break the rock apart. Rocks hitting other rocks by falling or being carried in fast-flowing streams can also cause rock to break. This breaking apart process is called weathering. This rock does not always stay in the delta, it can be washed away by the ocean. When humans-built structures that blocked new rock and sand from coming to the delta, the delta began to shrink.		

Preparation

MATERIALS NEEDED	AHEAD OF TIME
<p>Teacher Resources</p> <ul style="list-style-type: none">• TE1.1 animation of the Mississippi delta• TE5.2 <i>Lesson 5 Analogy Chart Answer Key</i> <p>Student Handouts</p> <ul style="list-style-type: none">• HO1.3 <i>How does land change to form a delta?</i>• HO5.1 <i>Investigation Directions</i> (1 per group)• HO5.2 <i>Lesson 5 Analogy Chart</i> (1 per student)• HO5.3 <i>Tree in Rock Photos</i> (1 per group)• HO5.4 <i>Soda Cans Photo</i> (optional; 1 per group) <p>Materials needed</p> <ul style="list-style-type: none">• 2 cans of soda (1 at room temperature and 1 frozen and deformed)• 1 small plastic bottle or tub with lid (per group)• 1 small bag of 4–6 rocks (per group) <p>Other Materials</p> <ul style="list-style-type: none">• chart paper and chart markers• computer and projector	<ul style="list-style-type: none">• Review the information in the <i>Content Background</i> document.• Prepare group materials for the weathering investigations. This includes freezing one of the cans of soda ahead of time. To avoid a potential mess, place the soda can in a resealable plastic bag before freezing. If a frozen soda can is not available, HO5.4 <i>Soda Cans Photo</i> can be used.• Prepare all handouts.• Gather a computer and projector and test playing the TE1.1 animation of the Mississippi delta located here: http://www.watchthedeltagrow.com/mississippi-river-paths.

Lesson 5 General Outline

Time	Phase of lesson	How the science content storyline develops
2 min	Link to Previous Lessons: Teacher builds links to ideas from previous lessons.	Erosion and deposition are ongoing processes. Where Earth's surface has built up can be worn down to build up again elsewhere.
5 min	Lesson Focus Questions: Teacher introduces the focus questions: <i>Where does the soil and rock in a delta come from, and where does it go? Does the rock and soil ever change?</i> Students share their initial ideas about the sand and soil in a delta.	
10 min	Setup for Activity 1: Teacher guides students in reviewing the directions for each investigation and creating an analogy chart to support understanding of how the materials relate to the focus questions.	
20 min	Activity 1: In small groups, students complete three investigations that challenge them to think about processes that break apart and wear down mountains and other surface landforms.	Smaller rocks were once part of bigger rocks. Rock breaks down all over the land because of rain, ice, vegetation, and wind.
20 min	Follow-up to Activity 1: Class discusses the investigation questions. Teacher introduces weathering. Students return to the Lesson 1 map to consider where the rock and soil is coming from.	Weathering is a process that causes rock to fragment, crack, and crumble. Weathered materials are carried away by gravity, water, and/or wind (erosion). Rocks that are carried away due to erosion previously came from bigger rocks. Rock and other weathered materials are transported between different land and water features.
5 min	Setup for Activity 2: Students rewatch the animation of the Mississippi delta growing and shrinking and consider with a shoulder partner how they might use the ideas they figured out to explain why the Mississippi delta looks the way it does.	Rock breaks down all over the land because of rain, ice, vegetation, and wind. This is the rock and soil carried away by rivers. As rocks continue to be carried away (erosion) by gravity, water, and/or wind, the rocks continue to break down into smaller pieces (weathering). These smaller pieces can be deposited in different places, building up the surface of Earth.
10 min	Activity 2: Students answer the Lesson Focus Questions and the Unit Central Question by revising their initial explanation of what is happening on Earth's surface.	
5 min	Follow-up to Activity 2: Students revisit their initial models and explain how their ideas have changed.	

10 min	Summarize Today's Lesson: Students revisit the DQB and check off what they can now answer. Students share how their thinking has changed about the Lesson Focus Questions and the Unit Central Question.	Weathering breaks down rocks to smaller pieces which then can be eroded and deposited elsewhere, changing the surface of Earth.
1 min	Link to Next Lesson: Teacher links ideas to next lesson.	

Time	Phase of lesson and how the science content storyline develops	STeLLA strategy	Teacher talk and questions	Possible student and teacher dialogue
2 min	<p>Link to Previous Lessons</p> <p><u>Synopsis:</u> Teacher builds links to ideas from previous lessons.</p> <p><u>Main Science Ideas:</u> Erosion and deposition are ongoing processes. Where Earth’s surface has built up can be worn down to build up again elsewhere.</p>	Link science ideas to other science ideas (links to previous lessons).	<p><i>Begin class by asking, What have we found out about how deltas grow and shrink?</i></p> <p><i>Reference the “Science Ideas We Figured Out” chart created at the end of Lesson 4 as needed.</i></p> <p>The Mississippi delta grows and shrinks as the sand and soil is moved from place to place. We found out that erosion and deposition are ongoing processes that continue to shape and reshape the land.</p>	<p>People can cause a delta to disappear.</p> <p>What do you mean?</p> <p>Building structures like dams on the river changed how the rocks and soil move.</p> <p>Can you say more about how a dam can change how the rocks and soil move?</p> <p>It changed where the rock and soil were deposited, like behind the dam instead of in the delta.</p> <p>How else does the rock and soil move in the delta?</p> <p>Sand that was deposited in the delta was washed away by the flow of water and ocean waves.</p> <p>Is there a science word we can use for “washed away”?</p> <p><i>(Pause.)</i></p> <p>Who can use that word to explain what happened to the sand in the delta?</p> <p>Sand that was deposited in the delta was eroded by the ocean waves.</p> <p>So, after rocks have been deposited, do they always stay there?</p> <p>No, rocks can be eroded again.</p>


<p>10 min</p>	<p>Setup for Activity 1</p> <p><u>Synopsis:</u> Teacher guides students in reviewing the directions for each investigation and creating an analogy chart to support understanding of how the materials relate to the focus questions.</p>		<p>Let's do some investigating.</p> <p>We will split into small groups and gather information to help us think about where the sand comes from and if the grains were always this size.</p> <p>NOTE TO TEACHER: <i>Place students into small groups (3 to 4 students). Pass out a copy of HO5.1 Investigation Directions to each group.</i></p> <p><i>The directions below suggest giving students instructions for all three investigations at the beginning. You may also decide to give directions for investigation A, have students work on investigation A, then gather the class together again to get directions for investigation B, and so on.</i></p> <p><i>Give instructions for completing the activity by saying something like, There is a series of three investigations—A, B, and C—you will need to complete.</i></p> <p>Please complete the investigations <i>in order</i>, starting with investigation A. As you finish each investigation, be sure to write in your science notebook your responses to all questions that occur at the end of that investigation.</p> <p>NOTE TO TEACHER: <i>Have students look at HO5.1 Investigation Directions. Briefly explain and/or model each of the three investigations. See the investigation descriptions on the handout and the brief example of a teacher's description two paragraphs below. Make sure you help students link the activity to the Lesson Focus Questions.</i></p>	
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		<p>Make explicit links between science ideas and activities (before activity).</p>	<p>Remember, your goal is to get ideas about where the sand comes from and if it was always this size. After each investigation, your group should (1) read the Lesson Focus Questions, (2) talk about any ideas the activity gave you about the focus questions, and (3) write your ideas in your science notebook in complete sentences.</p> <p><i>Describe the investigations similar to this:</i> For <u>investigation A</u>, you will observe two pictures of a tree growing in the crack of a boulder. The pictures are of the same tree and boulder and were taken in 1999 and 2014. Then you have two questions to answer in your science notebook.</p> <p>For investigations B and C, we will use models that represent parts of the real world. We will use an analogy chart to think about how each model relates to the real world.</p> <p>NOTE TO TEACHER: Pass out HO5.2 Lesson 5 Analogy Chart to each student.</p> <p>Let's take a look at <u>investigation B</u>. What are the materials for this investigation?</p> <p>In this model, the soda can represents a rock and the soda represents water. What do you think the frozen soda represents?</p> <p>Let's add these to our analogy chart now so that you can think about how these materials can help us understand the real world when you answer questions for this investigation.</p> <p>For <u>investigation C</u>, what are the materials for this investigation?</p> <p>What are we going to do with them?</p> <p>What do you think all this shaking represents?</p>	<p>Two cans of soda. One frozen, one not frozen.</p> <p>Frozen water in a rock.</p> <p>Rocks in a plastic bottle.</p> <p>Shake them for two minutes.</p> <p>Rocks moving around on Earth's surface</p> <p>What can cause rocks to move around?</p> <p>Water.</p> <p>What do others think?</p>
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		<p>Highlight key science ideas and <u>focus question</u> throughout.</p>	<p>What do you think the bottle represents?</p> <p>Let's add these comparisons to our analogy chart to help us think about our Lesson Focus Questions—<i>Where does the soil and rock in a delta come from, and where does it go? Does the rock and soil ever change?</i>—when we are doing these investigations.</p> <p>NOTE TO TEACHER: <i>Encourage students to ask questions if they do not understand or know what to do. Remind students that there are two questions to answer in their notebook for each investigation. Visit individual groups and question them about what they are doing and how doing that will help them answer the Lesson Focus Questions.</i></p> <p><i>Tell the class to send one person per team to pick up the tub of materials and begin. Remind students to do the investigations in order, beginning with investigation A. Allow 20 minutes total for these investigations.</i></p>	<p>Wind. Gravity.</p> <p>Hard objects the rock can bump into while it is moving.</p>
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<p>20 min</p>	<p>Activity 1</p> <p><u>Synopsis:</u> In small groups, students complete three investigations that challenge them to think about processes that break apart and wear down mountains and other surface landforms.</p> <p><u>Main Science Ideas:</u> Smaller rocks were once part of bigger rocks. Rock breaks down all over the land because of rain, ice, vegetation, and wind.</p>	<p>Engage students in analyzing and interpreting data and observations.</p> <p>Make explicit links between science ideas and activities (during activity).</p>	<p>NOTE TO TEACHER: Monitor the groups as they complete the series of investigations and respond to the questions. Listen to student ideas and probe student thinking when appropriate.</p> <p><i>Keep asking students how each investigation helps them think about the Lesson Focus Questions—Where does the soil and rock in a delta come from, and where does it go? Does the rock and soil ever change?</i></p> <p><u>Management Tip:</u> If you hear the loud shaking of rocks in the plastic container at the beginning of the activity, remind students to begin with investigation A.</p>	<p>Do these investigations give you any ideas about our Lesson Focus Questions: Where does the soil and rock in a delta come from, and where does it go? Does the rock and soil ever change?</p> <p>I see that the big rock busted in two over time where the tree was growing. So maybe smaller rocks come from bigger rocks.</p> <p>Did someone note something else? When the can of soda froze, the can deformed. But I am not sure what that has to do with rocks.</p> <p>Does someone in your group see how the soda can represents something with rocks? If the soda can represents rock with cracks in it or holes in it that get filled with water when it rains or snows, then when it freezes, the ice busts up the rock.</p> <p>What do others think about this idea?</p> <p>What about investigation C—how is this helping you answer the focus questions? I noticed that after I shook the rocks, the rocks didn't look much different but there was sand in the bottle. I didn't put any sand in the bottle.</p> <p>Where do you think the sand came from?</p>
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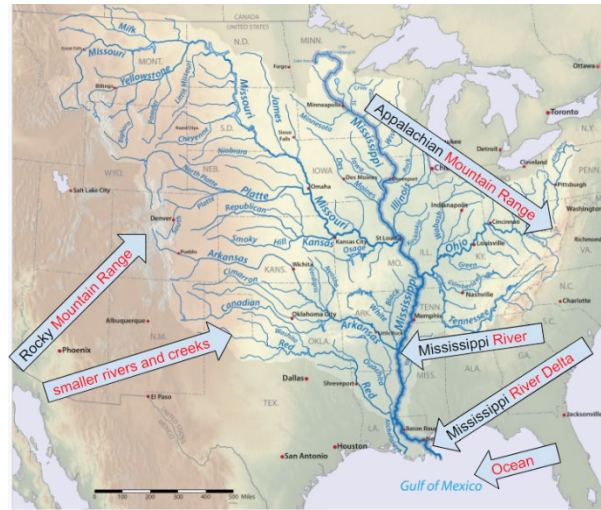
				<p>It must have broken off the rocks when they banged into each other as I was shaking the bottle.</p> <p>Do you notice anything similar happening in all three of these investigations?</p>
20 min	<p>Follow-up to Activity 1</p> <p><u>Synopsis:</u> Class discusses the investigation questions. Teacher introduces weathering. Students return to the Lesson 1 map to consider where the rock and soil is coming from.</p> <p><u>Main Science Ideas:</u> Weathering is a process that causes rock to fragment, crack, and crumble. Weathered materials are carried away by gravity, water, and/or wind (erosion). Rocks that are carried away due to erosion previously came from bigger rocks. Rock and other weathered materials are transported between different land and water features.</p>	<p>Make explicit links between science ideas and activities (after activity).</p> <p>Highlight key science ideas and <u>focus question</u> throughout.</p>	<p>OK, each group has had a chance to complete all the investigations. Let's take some time to review the investigations and talk about your ideas and responses.</p> <p>As we discuss the investigations, keep in mind today's focus questions, <i>Where does the soil and rock in a delta come from, and where does it go? Does the rock and soil ever change?</i></p> <p>NOTE TO TEACHER: Depending on time, you can have students share all their work on each investigation or pull the last question(s) from each investigation to discuss. The purpose of this review is to (1) highlight how rock can be broken apart by natural means and (2) introduce the process of weathering.</p> <p><u>Questions from each investigation</u></p> <p>Investigation A</p> <ol style="list-style-type: none"> 1. Describe what has happened to the tree and the boulder in the years between 1999 and 2014. 2. Predict what will happen to the boulder in another 50 years. Explain why you think so. <p>Investigation B</p> <ol style="list-style-type: none"> 3. Why was the frozen soda can deformed? What will happen to the can when the soda inside thaws? 4. Describe what you think happens over time when water freezes and then thaws in a crack in a rock. 	

		<p>Engage students in making connections by synthesizing and summarizing key science ideas.</p>	<p>Investigation C</p> <p>5. Describe what differences occurred to the rocks after the bottle was shook.</p> <p>6. Thinking back on what happened to the rocks in the bottle, explain what might happen to a large piece of rock that rolls down a mountain slope.</p> <p> <i>Listen to students' ideas. What's visible about student thinking? Allow students to share their ideas. Be sure to ask probing questions so that you understand student thinking before asking challenge questions.</i></p> <p>Did you notice anything that these investigations had in common?</p> <p>All three of these activities show different ways that rock can be broken apart and worn down. What ways are those?</p> <p>NOTE TO TEACHER: Show "Weathering Processes" image on PowerPoint slide.</p> <p>We call this process of rock getting broken down into smaller pieces <i>weathering</i>. Weathering causes rock to crack, crumble, and break down into smaller and smaller pieces.</p>	<p>A and C were about rocks.</p> <p>Can you say anything more? The rock got broken in A and rock got chipped off in C.</p> <p>What about B? Did B have anything to do with rock? It was about a soda can. But the question asked about freezing rocks.</p> <p>Can rock freeze? Water in the cracks of the rock can freeze.</p> <p>What might freezing do to the rock? It pushes the rock apart and causes it to break.</p> <p>Plant roots. Ice. Bumping against each other.</p>
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		<p>Highlight key science ideas and focus question throughout.</p>	<p>NOTE TO TEACHER: Write the statement in bold above—our main lesson idea—on a piece of chart paper or on the board. Additionally, if you use a Word Wall, add weathering to the vocabulary there.</p> <p>Using the three images of weathering processes on this slide, let’s add these processes to the last column of our analogy chart. (For sample language, see TE5.2 Lesson 5 Analogy Chart Answer Key.)</p> <p>Optional: The word <i>weathering</i> has a root word of <i>weather</i>. Based on the three investigations we did today, how do you think that weathering—breaking down rock into smaller pieces—is related to rock being exposed to the weather? Did anything we do in our activities relate to weather?</p> <p>Optional: <i>If you plan to use this lesson over two days, this could be a good stopping point, as students have just synthesized their learning from the first part of this lesson. If stopping, ask, How does the idea of weathering help us to answer our Lesson Focus Questions?</i></p> <p>So, let’s turn our attention back to the Lesson Focus Questions: <i>Where does the soil and rock in a delta come from, and where does it go? Does the rock and soil ever change?</i></p> <p>How did the three investigations help us understand why the delta has tiny grains of sand?</p> <p><i>Record student ideas on the Lesson 5 Focus Question chart, using the marker color for revised ideas.</i></p> <p>We learned that rocks and soil break apart and are moved through the processes of weathering and</p>	<p>The freezing of the rock had to do with how cold it gets. That’s got something to do with weather.</p> <p>The sand and soil in the delta came from bigger rocks. What do others think? Can we add on to that idea? Bigger rocks breaking into smaller rocks is called <i>weathering</i>. The broken rocks are moved to new locations by water and wind. This is called <i>erosion</i> and <i>deposition</i>.</p>
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		<p>Highlight key science ideas and <u>focus question</u> throughout.</p>	<p>erosion, but I am still wondering, <i>where does the soil and rock in the delta come from, and where does it go?</i></p> <p>Let's look back at our map that we used in our first lesson to see if we can get some ideas of where this rock is coming from and where it is going.</p> <p>Using this map, let's think back to our delta system diagram. Using our stream table models, we were focused on a small section of this map.</p> <p><i>Using your finger, outline a small portion of map that includes part of the Mississippi River, the land immediately on either side of the river, and where the river meets the ocean.</i></p> <p>We are going to expand the boundaries of the system we are studying. We are now going to consider this whole area as part of the system.</p> <p><i>Using your finger, outline a section of the map that includes the Mississippi River Basin, from the Rocky Mountain Range to the Appalachians, and include the Gulf of Mexico.</i></p> <p>When we zoom out and look at our map, what parts could be important to consider as we think about our lesson focus question?</p> <p>NOTE TO TEACHER: <i>Display the map on the slide (this is the same labeled map from Lesson 1). As the class expands the system boundaries, and students point out land and water features that might be important to consider, highlight the components labeled below.</i></p>	
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Link science ideas to other science ideas.



Looking at our expanded system, turn to your neighbor and point to places where you think the rock might come from and where it goes. Be sure to explain *why* you think rock and soil might be coming from or going to these places and *how* you think it is coming from or going to those places.

NOTE TO TEACHER: Have students turn and talk with their elbow partner about their initial ideas to answer the Lesson Focus Questions. Once they have talked, allow a few minutes for them to individually record their ideas in their notebook. Follow with a short whole-class discussion and record their ideas on the Lesson 5 Focus Question chart using the marker color for revised ideas.

Let's hear some of your ideas or your partner's ideas. *Where does the soil and rock in the delta come from, and where does it go?* Explain why and how you think it is coming from or going to those places.

I think the rock and soil in the delta comes from the sides of the river because we saw sand breaking away from the sides of the river on the stream table.

How do you think the rock is moving from the sides of the river?

The flow of water breaks off and moves the rocks to new places.

Where else do you think the rock and soil are coming from?

We thought it could be coming from the mountains because there are lots of big rocks there. Also, there are trees and sometimes ice that can break the rocks into smaller pieces.

And what's that called when rocks break down into smaller pieces?

Weathering.

If some of the rock and soil is coming from the mountains, how does it end up in the delta?

When rocks break, they can roll down the mountain into a river.

What do others think?

I think the small pieces of rock can also be moved to a new place by the wind.

Other ideas?



Listen to students' ideas. What's visible about student thinking? Listen for student ideas and connections among weathering, erosion, and deposition to build up land in the delta. Students may also talk about waves and ocean currents eroding the delta and depositing materials in the ocean. Make sure students are challenged to think about (1) how weathering, erosion, and deposition happen everywhere in the system; (2) connecting the rate of erosion to the slope and movement from higher mountain ranges down to the river; and (3) how rock and soil can be eroded in one place and then deposited elsewhere to build up land elsewhere.

The other rivers can carry them to the big river, and then it is moved down into the delta.

And what's that called when the earth's materials are transported to a new place?

Erosion is when the materials are moving and deposition is when it is dropped in a new location.

We have some ideas of where the rock is coming from. Where do you think it is going?

We learned that the rock is going into the delta. That's why the delta grew bigger over time.

What do others think? Is there anything you would like to add?


We also learned that sand in the delta is washed away into the ocean. This is why the delta is shrinking.

If erosion and deposition into the ocean was always happening, why wasn't the delta shrinking before?

Well, it changed when humans started building structures like dams and levees to stop flooding on the river.

Can you say more?

Dams and levees changed where the rock and soil deposited, so there was not as much rock and soil to replace what was washed away by the ocean.

5 min	<p>Setup for Activity 2</p> <p><u>Synopsis:</u> Students rewatch the animation of the Mississippi delta growing and shrinking and consider with a shoulder partner how they might use the ideas they figured out to explain why the Mississippi delta looks the way it does.</p> <p><u>Main Science Ideas:</u> Rock breaks down all over the land because of rain, ice, vegetation, and wind. This is the rock and soil carried away by rivers. As rocks continue to be carried away (erosion) by gravity, water, and/or wind, the rocks continue to break down into smaller pieces (weathering). These smaller pieces can be deposited in different places, building up the surface of Earth.</p>		<p>Now that we have had a chance to think about the rock and soil as it moves through different land and water features, you will have the opportunity to revise your initial explanation of what causes the Mississippi delta to look the way it does. How did new land form? Why did it begin to disappear?</p> <p>NOTE TO TEACHER: Rewatch the animation of the Mississippi delta growing and shrinking. http://www.watchthedeltagrow.com/mississippi-river-paths</p> <p><i>Invite students to turn to a shoulder partner and discuss how they might use the ideas they figured out over the last 5 lessons to explain why the Mississippi delta looks the way it does.</i></p>	
10 min	<p>Activity 2</p> <p><u>Synopsis:</u> Students answer the Lesson Focus Questions and the Unit Central Question by revising their initial explanation of what is happening on Earth's surface.</p>		<p>Open your science notebook and write your best answer to the questions: <i>Why does the Mississippi delta look the way it does? Where does the soil and rock in a delta come from, and where does it go? Does the rock and soil ever change?</i> Use evidence from our investigations and explain your reasoning. After you are done writing, you can add a drawing explaining how Earth's surface can change in this location.</p> <p> Embedded assessment task</p>	

	<p><u>Main Science Ideas continued</u>: Rock breaks down all over the land because of rain, ice, vegetation, and wind. This is the rock and soil carried away by rivers. As rocks continue to be carried away (erosion) by gravity, water and/or wind, the rocks continue to break down into smaller pieces (weathering). These smaller pieces can be deposited in different places building up the surface of Earth.</p>	<p>Engage students in making connections by synthesizing and summarizing key science ideas.</p>	<p>NOTE TO TEACHER: Students are writing an explanation for the Lesson Focus Questions and the Unit Central Question in the context of the Mississippi delta phenomenon. See the ideal student response to the Lesson Focus Questions on page 1 of this lesson plan as you assess student responses.</p>	
<p>5 min</p>	<p>Follow-up to Activity 2</p> <p><u>Synopsis</u>: Students revisit their initial models and explain how their ideas have changed.</p> <p><u>Main Science Ideas continued</u>: Rock breaks down all over the land because of rain, ice, vegetation, and wind. This is the rock and soil carried away by rivers. As rocks continue to be carried away (erosion) by gravity, water, and/or wind, the rocks continue to break down into smaller pieces (weathering). These smaller pieces can be deposited in different places, building up the surface of Earth.</p>		<p>Now that you have had a chance to record your explanation of what causes the Mississippi delta to grow and shrink, let's take a look our initial drawings and explanation on our Lesson 1 handout <i>How does land change to form a delta? (HO1.3)</i>.</p> <p>Compare your initial drawing and explanation to your explanation and drawing today. How have your ideas changed? Turn to a partner and describe what you now know and how you know it. You can use sentence stems from CSW row 11 to help.</p>	

10 min	<p>Summarize Today’s Lesson</p> <p><u>Synopsis:</u> Students revisit the DQB and check off what they can now answer. Students share how their thinking has changed about the Lesson Focus Questions and the Unit Central Question.</p> <p><u>Main Science Ideas:</u> Weathering breaks down rocks to smaller pieces which then can be eroded and deposited elsewhere, changing the surface of Earth.</p>	<p>Highlight key science ideas and focus question throughout.</p> <p>Summarize key science ideas.</p>	<p>We’ve learned a lot since we first created our Driving Question Board. What questions are we now able to answer? How has your thinking changed since our first lesson?</p> <p>NOTE TO TEACHER: <i>Lead students in identifying which clusters of questions they now know more about. Place a check mark on sticky note(s) that the class has now answered.</i></p> <p>Today we figured out answers to our Lesson Focus Questions: <i>Where does the soil and rock in a delta come from, and where does it go? Does the rock and soil ever change?</i> We learned that weathering breaks down rocks to smaller pieces, which then can be eroded and deposited elsewhere, changing the surface of Earth.</p> <p>We also revisited our Driving Question Board to see what we now know about the Unit Central Question, <i>What can cause Earth’s surface to look the way it does?</i> We now know ... [summarize key science ideas shared when revisiting the DBQ].</p>	
1 min	<p>Link to Next Lesson</p> <p><u>Synopsis:</u> Teacher links ideas to next lesson.</p>	<p>Link science ideas to other science ideas (links to next lesson).</p>	<p>In the next lesson, we are going to use these ideas to think about how weathering, erosion, and deposition can help us explain other landforms we can observe on Earth’s surface.</p>	



Transforming Science Education Through Research-Driven Innovation

Earth's Changing Surface

Lesson 5

Where does the soil and rock in a delta come from, and where does it go? Does the rock and soil ever change?



1

What have we figured out?



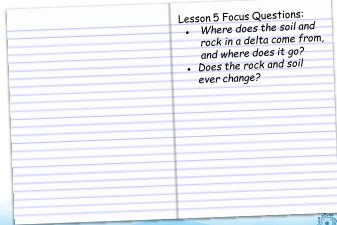
What have we figured out about how deltas grow and shrink?



2

Lesson 5 Focus Questions

Where does the soil and rock in a delta come from, and where does it go?
Does the rock and soil ever change?



3

Investigating to Answer Our Focus Questions



1. Complete investigation A.
2. When you finish investigation A, work with your group and
 - read the Lesson Focus Questions,
 - talk about any ideas the activity gave you to answer the focus questions, and
 - write your ideas in your science notebook (in complete sentences).

3. Repeat with investigations B and C.



4

Earth's Changing Surface
Analogy Chart - Lesson 5
Focus Questions: Where does the soil and rock in a delta come from and where does it go? Does the rock and soil ever change?

Part of model	Part of real world	Process
Soda can		
Soda in the can		
Frozen soda in the can	...later like...	
Picture of a tree root growing in a crack in a rock		



5

Investigating to Answer Our Focus Questions



1. Complete investigation A.
2. When you finish investigation A, work with your group and
 - read the Lesson Focus Questions,
 - talk about any ideas the activity gave you to answer the focus questions, and
 - write your ideas in your science notebook (in complete sentences).

3. Repeat with investigations B and C.



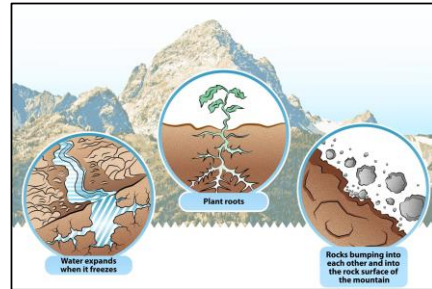
6

What do these investigations have in common?



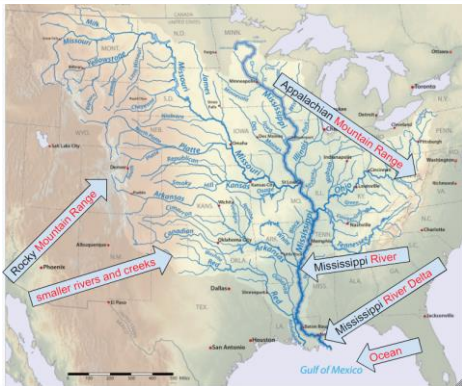
7

Weathering Processes



Weathering: the process that causes rock to crack, crumble, and break down into smaller and smaller pieces

8



9

The Life of the Mississippi Delta



animation link



10

Putting It All Together

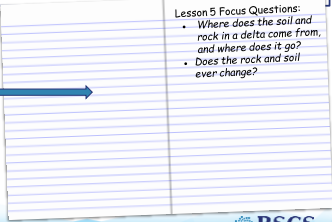
Why does the Mississippi delta look the way it does?

Lesson 5 Focus Questions

Where does the soil and rock in a delta come from, and where does it go?
Does the rock and soil ever change?

Write an explanation to answer the focus questions.

Draw sketches to help explain your thinking.



Lesson 5 Focus Questions:
• Where does the soil and rock in a delta come from, and where does it go?
• Does the rock and soil ever change?



11

How have your ideas changed?

Turn and talk with your partner.

✓ Use row # 11 from the CSW poster if you need help getting started.

11. Let your ideas change and grow.



I'm changing my idea, now I think I want to add to my idea I am going to write down _____ in my notebook.

What questions from our DQB can we answer now?



12

What other landforms can we explain?



13



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INVESTIGATION DIRECTIONS

Lesson Focus Questions: *Where does the soil and rock in a delta come from, and where does it go? Does the rock and soil ever change?*

While doing investigations A, B, and C, think about how they might help you answer the Lesson Focus Questions.

INVESTIGATION A

- Find the pictures of a tree growing out of a crack in a boulder.
- Talk about the pictures that were taken in 1999 and in 2014. What differences do you see?

In your science notebook

- 1) Describe what has happened to the tree and the boulder in the years between 1999 and 2014.
- 2) Predict what will happen to the boulder in another 50 years. Explain why you think so.

INVESTIGATION B

- Look at the two cans of soda. One can is frozen and the other is not.
- Talk about how the frozen soda can is different from the soda can that is not frozen.

In your science notebook

- 3) Why was the frozen soda can deformed? What will happen to the can when the soda inside thaws?
- 4) Describe what you think happens over time when water freezes and then thaws in a crack in a rock.

INVESTIGATION C

- Find the small plastic bottle and the bag of rocks.
- Count the rocks. Write this number in your science notebook.
- Place the rocks in the plastic bottle. Put the top on the bottle. Shake the jug vigorously for 2 minutes while holding the cap on the bottle. Pour out the rocks and count them. Write this number in your science notebook.

In your science notebook

- 5) Describe what differences occurred to the rocks after the jug was shook.
- 6) Thinking back on what happened to the rocks in the bottle, explain what might happen to a large piece of rock that rolls down a mountain slope.

“Earth’s Changing Surface”

Lesson 5 Analogy Chart

Lesson Focus Questions: *Where does the soil and rock in a delta come from, and where does it go? Does the rock and soil ever change?*

Part of model	... is/are like ...	Part of real world	Process:	
Soda can				
Soda in the can				
Frozen soda in the can				
<p align="center">Pictures of a tree root growing in a crack in a rock</p>				

“Earth’s Changing Surface”

Lesson 5 Analogy Chart Answer Key

Lesson Focus Questions: *Where does the soil and rock in a delta come from, and where does it go? Does the rock and soil ever change?*

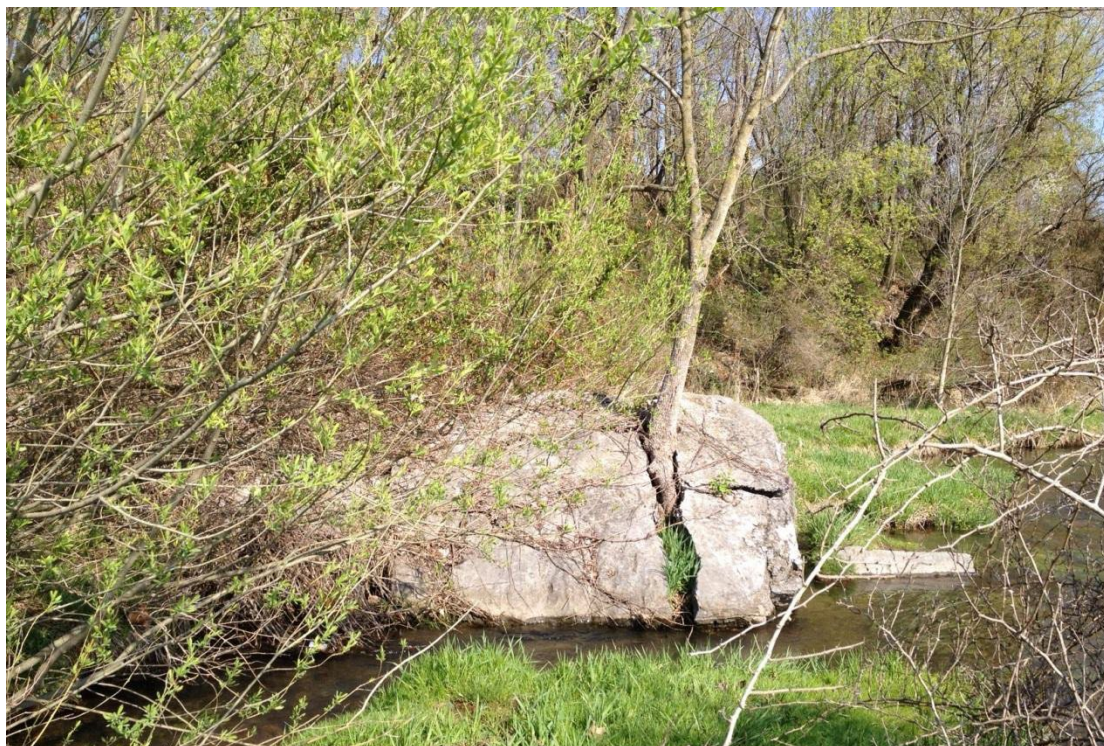
Part of model		Part of real world	Process: Weathering
Soda can	... is/are like ...	Rock	When water freezes and then thaws in a crack in a rock, the crack can widen and cause pieces of rock to break off.
Soda in the can		Water	
Frozen soda in the can		Frozen water in a rock	
Plastic bottle		Hard surfaces that rocks can bump into	When rocks roll down mountain slopes or hit other rocks as they are carried by the river, the rocks can break apart.
Rocks in the bottle		Rocks on land or in the water	
Shaking rocks in the bottle		Rocks falling or being moved by wind or water	
Pictures of a tree root growing in a crack in a rock			If a plant starts growing inside of a crack in a rock, as the plant gets bigger it can push apart the rock, causing it to break.

Tree in Rock Photos

Picture was taken in 1999.



Picture was taken in 2014.



photos courtesy of Dr. Christopher Woltemade; adapted from RESPeCT ©2014 CPP and BSCS Science Learning

Soda Cans Photo



Two soda cans. The soda can on the right was left in the freezer.

“Earth’s Changing Surface” Card Sort Set 1

Make one card set for each pair.

<p>3</p> <p>A map of the Mississippi delta over time shows the amount of land growing and then shrinking.</p>	<p>A</p> <p>Earth’s surface changes over time.</p>
<p>2</p> <p>In our stream table, the flow of water carried sand and rocks down the stream table and deposited it along the sides of the river or at the bottom.</p>	<p>D</p> <p>Water can pick up soil and rock and carry it downstream and deposit the soil and rock in other places.</p>
<p>1</p> <p>The amount of water, vegetation, and slope of the land affected how fast rock and soil moved and where rock and soil were deposited.</p>	<p>B</p> <p>Erosion and deposition can change Earth’s surface quickly or slowly.</p>
<p>4</p> <p>After adding a dam, we saw sand get trapped behind the dam and less sand was deposited at the bottom of our stream table.</p>	<p>C</p> <p>Humans can change how fast rock is eroded and where rock and soil are deposited.</p>

“Earth’s Changing Surface” Card Sort Set 2

Make one card set for each pair.

6

As a tree grew, its roots spilt a rock into two pieces. Frozen liquid caused a soda can to change shape and split open. Rocks tumbling and crashing into each other in a bottle caused the rocks to break apart.

5

There are land and mountain ranges on either side of the Mississippi River. Smaller rivers that flow into the Mississippi River can carry smaller pieces of rock and soil from one place and deposit them in another.

7

A sea arch forms over time out of a sea cliff.
Over time, sand dunes form between a windy, sandy area and a mountain range.
Over time, mountains become shorter and rounder.

8

F

Smaller rocks come from larger rocks. Water (rain, waves, ice), wind, or plants can cause rock to fragment, crack, and crumble into smaller pieces over time.

G

Earth’s surface is building up in some places and wearing down in others at the same time.

E

Weathering, erosion, and deposition are happening all the time all over Earth and continue to shape Earth’s surface.

H