

Earth's Changing Surface

Lesson 3a: Grand Canyon Explorers

Grade 2	Length of lesson: 50 minutes	Placement of lesson in unit: 3a of 6 two-part lessons on Earth's changing surface
Unit central questions: What does the surface of Earth look like? Does it ever change?		Lesson focus questions: Do landforms ever change? What evidence do we have?
Main learning goal: Landforms on Earth's surface change over time. Maps can help us identify and study these changes.		
Science content storyline: The land hasn't always looked the way it does today. Landforms on Earth's surface are changing all the time. Relief maps can help us identify and study landforms in different places.		
Ideal student response to the focus questions: We know that landforms change over time because the Grand Canyon is slowly getting deeper and deeper. We have evidence that these changes are happening because of the clues we gathered during our virtual tour of the canyon. Our evidence is that the Grand Canyon is 2 centimeters deeper than it was 50 years ago. We also know that the Colorado River is moving rock and soil out of the canyon.		

Preparation

<p>Materials Needed</p> <ul style="list-style-type: none"> • Science notebooks • Chart paper and markers • Plastic relief maps of the United States (from lesson 2a) (1 per group) • Google Earth Grand Canyon Tour from Pomona KMZ file or Grand Canyon Exploration KMZ file <p>Student Handouts and Teacher Masters</p> <ul style="list-style-type: none"> • 3.1 Grand Canyon Explorers, Part 1 (1 per student) • 3.2 Google Earth Tour Instructions (Teacher Master) 	<p>Ahead of Time</p> <ul style="list-style-type: none"> • Review the content background document. • Review the instructions on handout 3.2 (Google Earth Tour Instructions) for downloading and installing Google Earth Pro on your computer. Import either the Grand Canyon Tour from Pomona KMZ file (video only, no pop-up clues) or the Grand Canyon Exploration KMZ file, which allows you to manually control each placemark and includes the prerecorded video and pop-up clues. If you feel comfortable using Google Earth, we recommend using the Grand Canyon Exploration KMZ file and navigating through the clues manually. However, you may just play and pause the prerecorded video if you prefer.
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Lesson 3a General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
5 min	Link to previous lesson: The class reviews different types and patterns of landforms from previous lessons.	<ul style="list-style-type: none"> • Earth’s surface has many types of landforms. Landforms don’t look the same everywhere.
4 min	Lesson focus questions: The teacher introduces the focus questions, <i>Do landforms ever change? What evidence do we have?</i> Then students share their initial ideas.	
8 min	Setup for activity: The teacher uses a relief map to orient students to the Grand Canyon and identify its landforms.	<ul style="list-style-type: none"> • Relief maps can help us locate different places on Earth and study the landforms in those places.
20 min	Activity: Students watch a Google Earth video tour of the Grand Canyon and use informational clues to help them investigate whether the canyon is changing.	<ul style="list-style-type: none"> • Relief maps and other resources can help us locate different places on Earth and study the landforms in those places.
7 min	Follow-up to activity: Using evidence from the video tour and two informational clues, students share their ideas and explanations about whether the Grand Canyon is changing.	<ul style="list-style-type: none"> • The land hasn’t always looked the way it does today. Landforms on Earth’s surface are changing all the time, and sometimes they change very slowly.
5 min	Synthesize/summarize today’s lesson: The teacher summarizes key science ideas from the lesson.	<ul style="list-style-type: none"> • The land hasn’t always looked the way it does today. Landforms on Earth’s surface are changing all the time.
1 min	Link to next lesson: The teacher foreshadows the next lesson in which students gather more evidence to help them decide whether the Grand Canyon is changing.	

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5 min	<p>Link to Previous Lessons</p> <p>Synopsis: The class reviews different types and patterns of landforms from previous lessons.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • Earth’s surface has many types of landforms. Landforms don’t look the same everywhere. 	<p>Summarize key science ideas.</p> <p>Engage students in analyzing and interpreting data and observations.</p>	<p>Show slide 1.</p> <p>Last time, we looked at landforms in two different places.</p> <p>What did we learn about the landforms in Chicago, Illinois, and Salt Lake City, Utah, from looking at our relief maps?</p>	<p>We learned that some landforms in these places were the same, and others were different.</p> <p>Both places had flat land.</p> <p>Plains!</p> <p>Salt Lake City had mountains, but Chicago didn’t.</p>	<p>Can you tell me more about how some landforms were the same?</p> <p>So both Chicago and Salt Lake City had flat land. What is the landform name for this?</p> <p>You said that some landforms were different, too. What did you mean by that?</p>

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			<p>Show slide 2.</p> <p>So do we all agree that landforms look different in different places?</p> <p>Let's look at our relief map again. <i>[Hold up a map so everyone can see it.]</i></p> <p>What landform patterns did we find on the map in earlier lessons?</p> <p>Remember, we found patterns by looking across the entire map, not just in one place. Scientists use patterns to study why some places have certain landforms and others don't.</p>	<p>Chicago had lots of water!</p> <p>Salt Lake City didn't have as big a lake as Chicago.</p> <p>Yes!</p> <p>We saw that some places have lots of</p>	<p>What other differences did we notice in those places?</p> <p>What do you mean by "lots of water"? How is that different from Salt Lake City?</p>

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			<p>NOTE TO TEACHER: <i>During this review, encourage students to use compass directions (north, south, east, west) in their descriptions. If they're struggling, remind them where to find the direction symbol on the map.</i></p> <p>Great job, everyone! You've learned so much about landforms in this unit. Are you ready to learn more?</p>	<p>mountains and rough land, but other places are flat.</p> <p>In the west.</p> <p>Some parts of the United States have lots of rivers, too.</p> <p>We noticed that the middle part of the country was flat.</p> <p>Plains!</p>	<p>Where did we find lots of mountains on the map? Were they in the west, east, south, or north?</p> <p>Where did you notice lots of rivers on the map?</p> <p>What do we call the landform in the middle of the United States where it's mostly flat?</p>

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4 min	<p>Lesson Focus Questions</p> <p>Synopsis: The teacher introduces the focus questions, <i>Do landforms ever change? What evidence do we have?</i> Then students share their initial ideas.</p>	Set the purpose with a <u>focus question</u> or goal statement.	<p>Show slide 3.</p> <p>So we know that the land can look different in different places. And it can also look the same.</p> <p>But do you think the land has always looked the way it does today in places like Chicago or Salt Lake City?</p> <p>We'll investigate this idea today as we think about some new focus questions: <i>Do landforms ever change? What evidence do we have?</i></p> <p>Write these questions in your science notebooks and draw a box around them.</p> <p>NOTE TO TEACHER: <i>Write the focus questions on the board for students to refer to throughout the lesson.</i></p> <p>What do you think? Do landforms on Earth's surface ever change?</p> <p>NOTE TO TEACHER: <i>Record student ideas on chart paper. Note any surprising responses or confusion and ask questions to clarify students' thinking.</i></p> <p>ELL support: Encourage ELL students to respond to one another during this</p>	<p>Maybe, like, during an earthquake.</p> <p>Maybe the shaking causes the land to crumple?</p>	<p>Why do you think an earthquake might cause the land to change?</p>

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			<p>discussion. This is an important moment for sensemaking and building understandings that could be extended.</p> <p>That’s an interesting idea. Who has another idea?</p>	<p>I’m not sure if landforms change.</p> <p>Well, I think the land has always looked the same, but sometimes it might change, so I don’t know.</p>	<p>Can you tell me why you aren’t sure?</p> <p>So you think that mostly the land stays the same, but sometimes it might change. Is that right?</p>
8 min	<p>Setup for Activity</p> <p>Synopsis: The teacher uses a relief map to orient students to the Grand Canyon and identify its landforms.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Relief maps can help us locate different places on Earth and study the landforms in those 	Make explicit	<p>Today we’re going to take a virtual trip to a special place in Arizona called the Grand Canyon.</p> <p><i>A virtual trip</i> means we aren’t actually going to the Grand Canyon, but we’ll use a special tool to see it from our classroom. We’ll talk more about this tool in a moment, but first let’s talk about the Grand Canyon.</p> <p>On our virtual tour, we’ll think about</p>		

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	places.	links between science ideas and activities before the activity.	<p>whether the Grand Canyon might be changing.</p> <p>Show slide 4.</p> <p>This slide shows a picture of the Grand Canyon. Have any of you ever been to the Grand Canyon?</p> <p>What else do you notice about this picture?</p> <p>ELL support: Break down the meaning of <i>Grand Canyon</i> for ELL students. Ask them what <i>grand</i> means and what <i>canyon</i> means. Then ask students what a small canyon would be called.</p> <p>Let's find the Grand Canyon on our relief maps.</p> <p>NOTE TO TEACHER: <i>Have students gather in the same groups from the previous lesson. Then give each group a relief map.</i></p> <p>In your groups, see if you can find the</p>	<p>I haven't been there, but I've heard about it.</p> <p>It's really, really, really big!</p> <p>There's a lot of rock and hardly any plants!</p> <p>The canyon is really deep. It goes way down into the ground!</p>	<p>Is it big like really tall or big like really deep?</p>

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		Ask questions to elicit student ideas and predictions.	<p>Grand Canyon. Then talk about the landforms it has. Does the land rise high above the ground or cut deep into the ground?</p> <p>NOTE TO TEACHER: <i>Allow a few minutes for groups to find the Grand Canyon on their relief maps and discuss what kind of landform it is.</i></p> <p>Whole-class discussion: What do you think? Does the Grand Canyon rise high above Earth’s surface or cut deep into the surface?</p> <p>Do you think the Grand Canyon has always looked the way it does today?</p>	<p>I think the canyon cuts into Earth’s surface, but maybe it rises high above the surface, too.</p> <p>Well it’s really bumpy around the on the map, so I’m not sure.</p> <p>Yes, it’s always been there.</p>	<p>Can you tell me why you think it rises high above the surface, too?</p> <p>Do you mean that it has always been around or that it</p>

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			<p>It's OK if you don't know for sure, because the special Internet tool we'll be using today will help us explore the Grand Canyon from right here in our classroom. This special tool is called <i>Google Earth</i>.</p> <p>Google Earth uses satellites in space to show us what we would see if we were birds flying over the land. It can show us places from way up in the sky, but it can also zoom in close like a bird would. Isn't that cool?</p> <p>So imagine you're a bird flying way up in the sky and looking down at Pomona. What do you think you'd see?</p> <p>Well, that's what Google Earth shows us.</p> <p>Are you ready to explore the Grand Canyon like birds?</p>	<p>I'm not sure.</p> <p>I'd see mountains and a valley.</p>	<p>has always looked exactly the same as it does today?</p>
20 min	<p>Activity</p> <p>Synopsis: Students watch a Google Earth video tour of</p>	<p>Select content representations and models matched to the</p>	<p>NOTE TO TEACHER: <i>Distribute handout 3.1 (Grand Canyon Explorers, Part 1) and orient students to the tasks they'll be completing during the activity.</i></p>		

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	<p>the Grand Canyon and use informational clues to help them investigate whether the canyon is changing.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Relief maps and other resources can help us locate different places on Earth and study the landforms in those places. 	<p>learning goal and engage students in their use.</p>	<p>We'll begin our virtual tour in Pomona. Keep an eye out for landforms!</p> <p>NOTE TO TEACHER: <i>Start Google Earth Pro on your computer. The Google Earth Grand Canyon Tour from Pomona (or the Grand Canyon Exploration) will provide students with information (pictures and text) about the Grand Canyon, including three pop-up clues that also appear in the handout. Students will think about the first two clues in this lesson and the third clue in the next lesson. Make sure to stop today's tour after the second clue.</i></p> <p><i>Begin the virtual tour and pause the video at the first stop in Pomona. Ask students to identify any landforms they see.</i></p> <p>What landforms do you see as you look down at Pomona from the sky?</p> <p>NOTE TO TEACHER: <i>As students identify different landforms, record them on chart paper and have them record their observations on the handout. Also use this time to review landforms and, more importantly, orient students to Google Earth. Ask questions like "What do you think you're looking at?" Remind</i></p>		

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		<p>Make explicit links between science ideas and activities during the activity.</p>	<p><i>students to imagine that they're birds in the sky looking down on the land.</i></p> <p>Before we fly to the Grand Canyon, who can tell me what river runs through the canyon?</p> <p>That's right! We saw the Colorado River on our relief maps. Write this river on your handouts for question 2.</p> <p>NOTE TO TEACHER: <i>After students record the answer for question 2 on their handouts, continue the video tour and "fly" from Pomona to the Grand Canyon. Then pause the video again.</i></p> <p>In a moment, we'll fly over and into the Grand Canyon and search for clues about how the canyon was formed. The evidence we gather today and next time will help us decide whether the Grand Canyon is changing.</p> <p>First, we'll visit the rim at the top of the canyon, and then we'll fly down into the canyon.</p> <p>NOTE TO TEACHER: <i>Resume the</i></p>	<p>The Colorado River.</p> <p>We saw it on the map.</p>	<p>How do we know that?</p>

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			<p><i>virtual tour and pause the video after the first clue pops up in the Google Earth bubble. The clue also appears on the handout. Read the clue and the question on the handout aloud.</i></p> <p>Let's read our first clue and talk about what this clue tells us about the Grand Canyon.</p> <p>ELL support: Show ELL students what 2 centimeters looks like so they have a visual reference.</p> <p>So based on this clue, do you think the Grand Canyon could be changing?</p> <p>ELL support: Consider having ELL students talk about this question with a partner first. This will give them an opportunity to practice articulating their ideas before sharing them with the class and writing them on the handout.</p> <p>OK, take a moment and write down your ideas for answering question 3 on your</p>	<p>I think the canyon is getting deeper.</p> <p>The clue says that the canyon is 2 centimeters deeper than it was 50 years ago, when the scientist was a kid.</p> <p>Yeah, and every year the canyon gets deeper every year!</p>	<p>Why do you think so? What's your evidence?</p> <p>Does anyone have something to add?</p>

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		<p>Engage students in analyzing and interpreting data and observations.</p> <p>Engage students in constructing explanations and arguments.</p>	<p>handouts. Make sure to include evidence from the clue and the video tour in your explanations.</p> <p>NOTE TO TEACHER: <i>Give students a couple of minutes to process the first clue and write down their ideas before resuming the tour. Based on this clue, students should understand that the Grand Canyon is changing because it's getting a little deeper every year. Some students might point out that the canyon is changing slowly, since it is only 2 centimeters deeper than it was 50 years ago.</i></p> <p>OK, the next stop on our tour is the Colorado River.</p> <p>NOTE TO TEACHER: <i>Continue the virtual tour and stop the video when the second clue pops up in the Google Earth bubble. Read the clue and the handout question aloud.</i></p> <p>Let's read our second clue and talk about what it tells us.</p> <p>Based on this clue, do you think water from the Colorado River could be changing the canyon? How do you think that might happen?</p>	<p>I think that during</p>	

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		<p>Engage students in analyzing and interpreting data and observations.</p> <p>Engage students in</p>	<p>Now I'd like you to write down your ideas for answering question 4 on your handouts. Make sure to include evidence from the clue and the video tour in your explanations.</p> <p>NOTE TO TEACHER: <i>Give students a couple of minutes to process the second clue and record their ideas on the</i></p>	<p>floods, the water pushed big chunks of rock out of the canyon.</p> <p>Maybe a bad flood caused the canyon, like when it rains really heavy and we have landslides.</p> <p>When it floods, it washes out the canyon.</p> <p>A bunch of dirt and rocks and stuff.</p>	<p>Have you ever seen water push soil and rocks along anywhere else?</p> <p>What do you mean by "washes out the canyon"? What is being washed away?</p>

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		constructing explanations and arguments.	<p><i>handout for question 4. Based on the second clue, students should understand that water is very powerful and can create changes in the canyon.</i></p> <p>We'll save the final clue for our next lesson. Be thinking about the evidence we've gathered so far and what this evidence tells us about whether landforms can change.</p>		
7 min	<p>Follow-Up to Activity</p> <p>Synopsis: Using evidence from the video tour and two informational clues, students share their ideas and explanations about whether the Grand Canyon is changing.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> The land hasn't always looked the way it does today. Landforms on Earth's surface are changing all the time, and sometimes they change very slowly. 	Ask students questions to elicit student ideas and predictions.	<p>NOTE TO TEACHER: <i>Have students pair up with an elbow partner and share their ideas about whether they think the Grand Canyon is changing based on the evidence they've gathered so far.</i></p> <p>Show slide 5.</p> <p>What did we learn from our virtual trip to the Grand Canyon? What evidence did we find that can help us decide whether the canyon is changing?</p>	<p>We saw how deep the Grand Canyon is and how far the Colorado River goes.</p> <p>That didn't give us any evidence, but</p>	Did this give us any evidence that the Grand Canyon may be changing?

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		<p>Make explicit links between science ideas and activities after the activity.</p> <p>Engage students in constructing explanations and arguments.</p>	<p>Did we find any other evidence that tells us the Grand Canyon might be changing?</p> <p>ELL support: To help ELL students construct understandings in their home language as well as in English, give them time to talk about the evidence in shared-language groups, if possible.</p> <p>Show slide 6.</p> <p>Turn and Talk (3 min): Now I'd like you to pair up with an elbow partner and talk about whether you think the Grand Canyon is changing. Make sure to include the evidence we gathered from our clues. Be ready to share your ideas with the class.</p>	<p>the clues did.</p> <p>We found out that the Grand Canyon is 2 centimeters deeper than it was 50 years ago.</p> <p>The second clue told us that the Colorado River picks up loose rocks and dirt when it flows through the canyon.</p> <p>If the rocks and soil get carried out of the canyon, that could make it deeper.</p>	<p>What did we find out from the first clue?</p> <p>How do we know that changes the canyon?</p>

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			<p>Whole-class share-out: So do you think the Grand Canyon is changing? Who would like to share your ideas?</p> <p>Does anyone have another idea to share about whether the Grand Canyon is changing?</p> <p>ELL support: Encourage ELL students to comment on one another's ideas. Giving them opportunities to respond to one another will help them understand the content better and participate more fully in the class discussion.</p> <p>So some of you think the Grand Canyon is changing based on our first two clues.</p> <p>What do you think might be causing the Grand Canyon to get deeper?</p>	<p>We think the Grand Canyon is changing because it's getting deeper.</p> <p>Clue 1 told us it's 2 centimeters deeper than it was 50 years ago.</p> <p>I think maybe the land caved in where</p>	<p>How do you know the canyon is getting deeper? What's your evidence?</p>

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				<p>the Grand Canyon is.</p> <p>I think maybe the canyon had really sandy dirt that washed away, like at the beach.</p> <p>Maybe the sand is building up the sides of the canyon?</p>	<p>Why do you think the sand is building up the sides of the canyon?</p>
5 min	<p>Synthesize/Summarize Today's Lesson</p> <p>Synopsis: The teacher summarizes key science ideas from the lesson.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> The land hasn't always looked the way it does today. Landforms on Earth's surface are changing all the time. 	<p>Highlight key science ideas and focus question throughout.</p>	<p>Show slide 7.</p> <p>Next, let's revisit our focus questions, <i>Do landforms ever change? What evidence do we have?</i></p> <p>Based on what we learned today, do you think that landforms change? What evidence have we gathered so far to help us answer this question?</p> <p>ELL support: Give ELL students an opportunity to talk about their ideas in small groups or with a partner. It may be</p>	<p>I think landforms change because the Grand Canyon is getting deeper.</p>	<p>What evidence do we have that the</p>

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			<p>difficult for students to shift from talking about the Grand Canyon to talking about landforms in general. Make sure they understand what's expected of them in this discussion.</p>	<p>One of our clues said that canyon is 2 centimeters deeper than 50 years ago.</p> <p>Our second clue said that the Colorado River carries rock and soil with it as it flows through the canyon.</p> <p>I still think that some landforms don't change. Like maybe flat ground is always flat.</p> <p>I don't know for sure, but I think maybe the land caves in sometimes.</p> <p>Like a hole is made</p>	<p>Grand Canyon is getting deeper?</p> <p>Does anyone have a different idea?</p> <p>That's an interesting idea. Is flat ground always flat? What do others think?</p> <p>What do you mean by "the land caves in sometimes"?</p>

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		Summarize keys science ideas.	<p>Show slide 8.</p> <p>Today we explored the Grand Canyon from right here in our classroom with the help of Google Earth. On our trip, we discovered two important clues or pieces of evidence:</p> <ol style="list-style-type: none"> 1. The Grand Canyon is 2 centimeters deeper than it was 50 years ago. 2. The Colorado River carries loose soil and rock with it as it flows through the canyon. 	<p>in the land.</p> <p>Yes.</p>	<p>So if the land caves in, is it changing?</p>
1 min	<p>Link to Next Lesson</p> <p>Synopsis: The teacher foreshadows the next lesson in which students gather more evidence to help them decide whether the Grand Canyon is changing.</p>	Link science ideas to other science ideas.	<p>Show slide 9.</p> <p>Based on these clues, we think the Grand Canyon could be changing, but we need more evidence to be sure.</p> <p>Next time, we'll continue our virtual tour of the Grand Canyon and think about one final clue that will help us decide whether the canyon is changing.</p> <p>The evidence we gather will also help us decide whether landforms change.</p>		