

## Earth's Changing Surface

### Lesson 3: Grand Canyon Explorers

<b>Grade: 2</b>	<b>Length of lesson:</b> 50 minutes	<b>Placement of lesson:</b> 3 of 6 lessons in the Earth's changing surface lesson series.
<b>Unit Central Questions:</b> What does the surface of Earth look like? Does it ever change?		<b>Lesson Focus Questions:</b> Do landforms ever change?
<b>Main learning goal:</b> Landforms change over time.		
<b>Science content storyline:</b> The land hasn't always looked like it does today. Landforms are changing all the time. Maps can be used to locate different places on Earth and study the landforms of that place.		
<b>Ideal student response to the Focus Question:</b> The Grand Canyon is changing. It is slowly getting deeper and deeper. That means that landforms do change over time.		

#### Preparation

MATERIALS NEEDED	AHEAD OF TIME
<p><b>Teacher Masters:</b></p> <ul style="list-style-type: none"> <li>• Lesson 4 PowerPoint</li> <li>• Google Earth Grand Canyon Tour of Pomona KMZ file OR Google Earth Exploration KMZ file</li> <li>• 3.2 Google Earth Instructions</li> </ul> <p><b>Student Handouts:</b></p> <ul style="list-style-type: none"> <li>• US Relief Map (From lesson 2)</li> <li>• 3.1 Grand Canyon Explorers (1 per student)</li> </ul>	<ul style="list-style-type: none"> <li>• Review the information in the Content Background Document.</li> <li>• Prepare all handouts.</li> <li>• Download Google Earth. Import either the Grand Canyon Tour from Pomona (KMZ file with video only) or import the Grand Canyon Exploration KMZ file that allows you manual control over each placemark (this file also include pre-recorded video).</li> </ul> <p>Note: If you feel comfortable using Google Earth, use the Grand Canyon Exploration KMZ file and navigate through the clues manually. However, you may also just play and pause a pre-recorded video that is provided.</p>

### Lesson 3 General Outline

Time	Phase of lesson	How the Science Content Storyline Develops
4 min	<b>Link to Previous Lesson:</b> Students review the different patterns and types of landforms from Lessons 1 and 2.	There are many different types of landforms. Landforms do not look the same everywhere.
3 min	<b>Lesson Focus Questions:</b> Teacher introduces the Lesson Focus Questions: <i>Do landforms ever change?</i> Students talk about their ideas.	
10 min	<b>Setup for Activity:</b> Teacher uses relief map to set-up an activity where students will investigate if the Grand Canyon is changing.	Maps can be used to locate different places on Earth and study the landforms of that place.
20 min	<b>Activity:</b> Students use Google Earth, along with informational text and illustrations, to investigate whether the Grand Canyon is changing.	Maps can be used to locate different places on Earth and study the landforms of that place.
7 min	<b>Follow-up to Activity:</b> Using evidence from Google Earth and their investigation, students construct an explanation about change in the Grand Canyon.	The land hasn't always looked like it does today. Landforms are changing all the time.
5 min	<b>Summarize and Synthesize:</b> Teacher summarizes key science ideas from the lesson.	The land hasn't always looked like it does today. Landforms are changing all the time.
1 min	<b>Link to Next Lesson:</b> Teacher links to next lesson by telling students they will study what causes landforms to change.	

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4 min	<p><b>Link to previous ideas</b></p> <p><u>Synopsis:</u> Students review the different patterns and types of landforms from Lessons 1 and 2.</p> <p><u>Main science ideas:</u> There are many different types of landforms. Landforms do not look the same everywhere.</p>	Ask questions to elicit student ideas and predictions.	<p><b>NOTE TO TEACHER:</b> Write on the board or use the PowerPoint: Landforms look different from one place to another.</p> <p>Last time we looked at landforms on a map. What did we learn about landforms from looking at the map?</p>	<p>We learned that some things are the same and some are different.</p> <p>They both had flat land.</p> <p>Plains!</p> <p>Well Denver had mountains but Chicago didn't.</p> <p>Chicago had lots of water!</p> <p>Denver didn't have a big lake like Chicago.</p>	<p>Can you tell me more about how things are the same?</p> <p>So both Chicago and Denver had flat land. What is that called again?</p> <p>You said they were different too. What did you mean by that?</p> <p>When you say lots of water, what do you mean? How is that different from Denver?</p>

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			<p>Ok, so we can agree that landforms are different in different places.</p> <p>Now, looking at the relief map again (<i>hold up a relief map in front of the class</i>), do you remember any patterns about where landforms were located from looking at the map? Remember patterns are things we notice across the entire map, not just in one place. Scientists use patterns to study why certain landforms occur in some parts of the country, but not in others.</p> <p><b>NOTE TO TEACHER:</b> <i>Students in second grade will likely not use cardinal directions, such as east and west. If appropriate, you can prompt them to describe where they see landforms using cardinal directions or you can assist them by saying “By this ‘side of the map’, do you mean the west?”</i></p>	<p>We saw that some places have lots of mountains and rough land, but other places are flat.</p> <p>Some parts of the United State have lots of rivers too.</p> <p>We saw the mountains too, and also that the middle part was flat.</p>	

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3 min	<p><b>Focus Question</b></p> <p><u>Synopsis:</u> Teacher introduces the Lesson Focus Questions: <i>Do landforms ever change?</i> Students talk about their ideas.</p>	Set the purpose with a focus question or goal statement.	<p>Ok, so we know that the land is different in different places. But, did the land always look like that in Chicago? Or in Denver? <i>Does the land ever change?</i> That is our focus question for today.</p> <p><b>NOTE TO TEACHER:</b> Write the focus question on the board or use the PowerPoint slide.</p> <p>What do you think? Do you think land changes?</p> <p>That's an interesting idea. What about others?</p>	<p>Maybe, like during an earthquake.</p> <p>Maybe the shaking causes the land to crumple?</p> <p>I'm not sure if it changes?</p> <p>Well it has always looked the same, but sometimes it might change, but I don't know.</p>	<p>Why do you think an earthquake can cause the land to change?</p> <p>Can you tell me why you are not sure?</p> <p>So you think that mostly it might stay the same, but it</p>

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					might change some times?
10 min	<p><b>Set up for Activity</b></p> <p><u>Synopsis:</u> Teacher uses relief map to set-up an activity where students will investigate if the Grand Canyon is changing.</p> <p><u>Main Science Ideas:</u> Maps can be used to locate different places on Earth and study the landforms of that place.</p>		<p>Ok, so today we are going to take a “virtual trip” to a special place to think about whether the land changes over time. We are going to use Google Earth to fly from our city to the Grand Canyon and then learn more about how the Grand Canyon formed. Have any you ever been to the Grand Canyon? Or have you seen pictures of the Grand Canyon?</p> <p>Let’s find the Grand Canyon on our relief maps from yesterday. In your groups see if you can find it and talk about whether it is a landform that rises high above the ground or a landform that cuts into the ground.</p> <p><b>NOTE TO TEACHER:</b> Take a few minutes for students to find the Grand Canyon on the relief map and talk to one another about whether it is a tall landform or one that cuts into the Earth.</p>	<p>I haven’t been there, but I heard about it.</p> <p>I have been there and it is really, really, really big!</p> <p>It is 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>What do you think? Does the Grand Canyon rises high above the surface of Earth or cut into the surface?</p> <p>Ok, and do you think the Grand Canyon always looked like it does today?</p> <p>That's ok if you don't know for sure! Because today we will use a special tool, called Google Earth, to explore the Grand Canyon. Google Earth shows us what the land looks like if we were a bird flying over the land. Isn't that cool? So if a bird is flying way up in the sky and looks down over Pomona, what would the bird see? That is what Google Earth shows us.</p> <p>So today we can pretend to be birds and we get to explore the land how a bird would see it from above looking down. So let's explore!</p>	<p>I think it cuts into the surface, but maybe it also rises up too.</p> <p>Well it is really bumpy around it so I'm not sure.</p> <p>Yes, it has always been there.</p> <p>I'm not sure.</p>	<p>Can you tell me why you think it rises up too?</p> <p>Do you mean that it has always been there, or do you mean that it has looked exactly the same?</p>

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20 min	<p align="center"><b>Activity</b></p> <p><u>Synopsis:</u> Students use Google Earth, along with informational text and illustrations, to investigate whether the Grand Canyon is changing.</p> <p><u>Main science ideas:</u> Maps can be used to locate different places on Earth and study the landforms of that place.</p>	Select content representations and models matched to the learning goal and engage students in their use.	<p><b>NOTE TO TEACHER:</b> Begin the Google Earth Tour from Pomona to the Grand Canyon. Pause the video in Pomona and ask students identify any landforms they see. Give them time to write these landforms on their Grand Canyon Explorers handout.</p> <p><i>Use this time to review any landforms, but more importantly, help students orient themselves to using Google Earth. Ask, what do you think you are looking at? Remember, we are birds in the sky looking down on the land.</i></p> <p><i>The video then “flies” from Pomona to the Grand Canyon. Then pause the video.</i></p> <p>What do you think about the Grand Canyon? Is it big or small? What river runs through it? Let’s find out!</p> <p>We are going to fly into the Grand Canyon and search for clues about how the Grand Canyon was formed. As a whole class, we will gather clues about the Grand Canyon. Then you will work in partners to make</p>		

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			<p>decisions about whether the Grand Canyon is changing.</p> <p><i><b>NOTE TO TEACHER:</b> Continue the Google Earth Tour. It will take you to three places in the Grand Canyon and provide students with a picture and text (which matches the Grand Canyon Explorers handout). It will also give a clue. Pause the video throughout, after each pop-up bubble, to give students time to process the clues. Ask students to write down their ideas about each clue while you pause the tour.</i></p> <p>First, we will visit the top of the rim and then will travel into the canyon. Let’s look for our first clue.</p> <p><i><b>NOTE TO TEACHER:</b> The clue will pop up in the Google Earth bubble. Students also have a copy on their handout. Read the clue aloud and then pause for students to consider the two questions.</i></p> <p><u>Clue #1:</u> A scientist visited the Grand Canyon this past year with his family. As they learned about the Grand Canyon, he found out that the Canyon was about 2 centimeters deeper now than it was when he visited the canyon with his parents fifty years ago. It is getting deeper each year.</p>		

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			<p>What do you think? Do you think the Grand Canyon is changing?</p> <p>Ok, on your handout, write down if you think the canyon is changing. Explain why or why not.</p> <p><i><b>NOTE TO TEACHER:</b> Students should use the clue to understand that the Grand Canyon is changing, getting a little deeper every year. Some students might even point out that it is changing slowly since it is only 2 cm. per year. Give students a couple of minutes to write down their ideas.</i></p> <p>Ok, let's travel along the Colorado River to our next clue.</p> <p><i><b>NOTE TO TEACHER:</b> The second clue will pop up in the Google Earth bubble. Students also have a copy on their handout. Read the clue aloud and then pause for students to consider the question for the</i></p>	<p>I think it is getting deeper.</p> <p>It says it is 2 feet deeper than when he was a kid.</p> <p>Yeah and every year is gets 2 centimeters more deep.</p>	<p>And what evidence do you have from the clue?</p>

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			<p><i>second clue.</i></p> <p><u>Clue #2:</u> Swift, powerful water cuts through the canyon carrying any loose soil and rocks.</p> <p>What do you think? Can water change the canyon? How?</p> <p><b>NOTE TO TEACHER:</b> <i>Students should use the clue to understand that water is very powerful and can create change in the canyon. Give students a couple of minutes to write down their ideas.</i></p> <p>Finally we will travel to the end of the Grand Canyon for our final clue. This is Lake Mead. Let's read our final clue closely.</p>	<p>I think that during floods, big chunks of rock were pushed out of the canyon by the water.</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>By “washes out the canyon”, what do you mean? What is being washed away?</p>

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			<p><b>NOTE TO TEACHER:</b> <i>The final clue will pop up in the Google Earth bubble. Students also have a copy on their handout. Read the clue aloud and then pause for students to consider the question for the final clue.</i></p> <p><u>Clue #3:</u> Lake Mead is the lake at the end of the Grand Canyon. It is slowly filling with soil and rocks carried down from the Colorado River.</p> <p>Where does the rock and soil come from? Does that mean the canyon is changing?</p> <p><b>NOTE TO TEACHER:</b> <i>Students should use the clue to understand that soil and rocks from the canyon are being moved from the Canyon to Lake Mead. Help them make the connection between clues 1, 2, and 3 that water is slowly changing the canyon by carrying soil and rock out of the canyon and depositing it into Lake Mead. Then, give students a couple of minutes to write down their ideas.</i></p>	<p>It is coming from the river.</p> <p>Maybe from anywhere, or maybe it is coming from the canyon during floods.</p> <p>Dirt that is being moved from inside the canyon to the</p>	<p>What do you mean by coming from the river? Is it coming from anywhere along the river?</p> <p>So if soil and rocks are being carried out of the canyon, then what is happening to the canyon when the soil and rock are moved to another place?</p>

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				<p>lake.</p> <p>Well, the dirt from the canyon has to go somewhere and the water carries it to the lake.</p> <p>Maybe that is why the canyon is getting deeper because some of dirt is getting dug out of the canyon by the river.</p>	
7 min	<p><b>Follow-up Activity</b></p> <p><u>Synopsis:</u> Using evidence from Google Earth and their investigation, students construct an explanation about change in the Grand Canyon.</p> <p><u>Main science ideas:</u> The land hasn't always looked like it does today. Landforms are changing all the time.</p>	Engage students in constructing explanations and arguments.	<p>So now that we have explored the Grand Canyon and we gathered clues about the canyon, in your pairs, I want you to develop an explanation for whether you think the Grand Canyon is changing. Formulate your explanation using this sentence frame:</p> <p>We think the Grand Canyon <u>is/is not</u> changing because _____ (use information from the clues).</p> <p><b>NOTE TO TEACHER:</b> Give the partners a few minutes to talk through their ideas and formulate a group answer.</p>		

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		Ask students questions to elicit student ideas and predictions.	<p>Ok are there any groups that would like to share their ideas?</p> <p>Did any other groups have a similar or different idea?</p> <p><i><b>NOTE TO TEACHER:</b> Allow other groups to share their explanation.</i></p> <p>So we think that the Grand Canyon is changing based on some of our clues. Now let's think about what might be causing it to change.</p> <p>Look at the Grand Canyon from above. I want you to think about how the Grand Canyon might have been formed. On your <i>Grand Canyon Explorers</i> notebook, write down your hypothesis: I think _____ is</p>	<p>We think the Grand Canyon is changing because it is getting deeper.</p> <p>Clue 1 said it was getting deeper by 2 cm every 50 years.</p> <p>We think it is changing too, but we also think that the dirt and rock are filling up Lake Mead.</p> <p>Well, maybe the dirt is coming from the canyon.</p>	<p>How do you know it is getting deeper? Can you use information from a clue to provide evidence?</p> <p>And why does that mean the Grand Canyon is changing?</p>

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			<p><i>causing the Grand Canyon to change.</i></p> <p>You don't need to know the answer right now- we are going to find out soon. Would anyone like to share your hypothesis?</p> <p>Ok, we will learn more tomorrow about what has caused the Grand Canyon to form, so keep your hypotheses in mind.</p>	<p>I think maybe the land caved in where the Grand Canyon is.</p> <p>I think maybe it is 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>Can you tell me why you think it is building up?</p>
5 min	<p><b>Summarize/Synthesize</b></p> <p><u>Synopsis:</u> Teacher summarizes key science ideas from the lesson.</p> <p><u>Main science ideas:</u> The land hasn't always looked like it does today. Landforms are changing</p>	Highlight key science ideas and focus questions throughout.	But, now, let's think about our focus question for today, <i>Do landforms ever change?</i> Do you think we have evidence now to answer this question?	<p>I think they can change because the Grand Canyon is changing.</p> <p>I still think that some landforms don't change. Like maybe</p>	

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	all the time.	Summarize keys science ideas.	<p>That’s an interesting idea. Is flat ground always flat? What do others think?</p> <p>So today we explored the Grand Canyon and we gathered 3 clues, or pieces of evidence. They were:</p> <ul style="list-style-type: none"> <li>• The canyon is getting deeper, about 2 cm per year.</li> <li>• The river is moving soil and rock because the water is very powerful and it can carry it out of the canyon.</li> <li>• Soil and rock has been left behind (deposited) in the lake below the Grand Canyon. That means the soil and rock has come from the Grand Canyon and is moving.</li> </ul> <p>Based on the evidence, we can agree that:</p> <ul style="list-style-type: none"> <li>• Landforms, like the Grand Canyon, can change.</li> </ul>	<p>flat ground is always flat?</p> <p>I don’t know for sure, but I think maybe it caves in sometimes.</p> <p>Like a hole is made in the land.</p> <p>Yes.</p>	<p>By caves in, what do you mean?</p> <p>So if the land caves in, then is it changing?</p>
1 min	<p><b>Link to Next Lesson</b></p> <p><u>Synopsis</u>: Teacher links</p>		So, if landforms change, what do you think causes them to change? What is causing the Grand Canyon to change? Think about this		

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	to next lesson by telling students they will study what causes landforms to change.		<p>tonight and we will learn more about it tomorrow.</p> <p><i><b>NOTE TO TEACHER:</b> Pose this question to the class, but you do not need to discuss it now- it will be the focus of Lesson 4.</i></p>		