

# Lesson 18

## Global Patterns of Mountain Ranges

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### Prepare

In Lesson 18, students analyze photographs of four canyons around the world and locate these canyons on a map. Students then identify patterns in the map and photographs that serve as evidence supporting an explanation about how rivers carve mountains to form canyons.

### Student Learning

#### Knowledge Statement

Patterns of Earth's features reveal that canyons form when rivers carve mountains.

#### Objective

- Lesson 18: Explain how mountains are carved by rivers to form canyons.

### Concept 3: Patterns in Features and Processes

#### Focus Question

How do canyons around the world form?

#### Phenomenon Question

How do natural features and processes affect canyon formation?

## Texas Essential Knowledge and Skills Addressed

- 5.3A **Analyze, evaluate, and critique scientific explanations using evidence**, logical reasoning, and experimental and observational testing. (Addressed)
- 5.7B **Recognize how landforms such as deltas, canyons, and sand dunes are the result of changes to Earth's surface by wind, water, or ice.** (Addressed)

## English Language Proficiency Standards Addressed

- 1C Use strategic learning techniques such as concept mapping, drawing, memorizing, comparing, contrasting, and reviewing to acquire basic and grade-level vocabulary.

## Materials

		Lesson 18
<b>Student</b>	Science Logbook (Lesson 18 Activity Guides A, B, C, and D)	●
<b>Teacher</b>	Canyons around the World Photographs (Lesson 18 Resource A)	●
	World Relief Map (Lesson 18 Resource B)	●
	Anchor model	●
<b>Preparation</b>	None	

# Lesson 18

**Objective:** Explain how mountains are carved by rivers to form canyons.

## Launch 7 minutes

Display the anchor model. Use the following prompts to introduce the lesson.

- ▶ **What claim can we make about the role of the Colorado River in the formation of the Grand Canyon?**
  - *The river weathered and eroded the rock layers to form the Grand Canyon.*
  
- ▶ **What evidence have we gathered to support our claim?**
  - *We saw in our weathering investigations that water can break rock into sediment over time.*
  - *We saw in our erosion investigations that a river can move sediment to different places.*
  
- ▶ **How can we investigate this claim further? What evidence can we gather?**
  - *We can look for pictures of Earth's surface before the Colorado River was there. If the river carved the Grand Canyon, there will be no canyon or river.*
  - *We can look at other canyons and see whether they have rivers in them too. If a river carved the Grand Canyon, other canyons might have been carved by rivers. 🐞*
  - *We can look at other canyons to see what is around them.*

## Agenda

Launch (7 minutes)

Learn (35 minutes)

- Investigate Different Canyons (10 minutes)
- Interpret a Relief Map (15 minutes)
- Organize Knowledge about Earth's Features and Processes (10 minutes)

Land (3 minutes)



## Extension

Students investigate other canyons in this lesson. As an extension activity, have students investigate other rivers to see whether they have formed canyons.

Based on this discussion, develop a class claims chart to summarize the class’s claim and investigation ideas related to answering the Phenomenon Question **How do natural features and processes affect canyon formation?**  Students should record the class claims chart in their Science Logbooks (Lesson 18 Activity Guide A).

As the class gathers evidence to help evaluate students’ claims throughout Lesson 18, continue referring to this chart.

Sample class claims chart: 

Canyon Formation	
Phenomenon Question: How do natural features and processes affect canyon formation?	
<b>Claim</b>	<b>Investigation Ideas</b>
<ul style="list-style-type: none"> <li>Rivers cause canyons to form by weathering rock layers over time and eroding the sediment.</li> </ul>	<ul style="list-style-type: none"> <li>Research canyons in other parts of the world.</li> <li>Look for canyons around the world to see whether they have a river at the bottom.</li> <li>Look at maps to see what else is around other canyons.</li> </ul>
<b>Evidence</b>	

## Learn 35 minutes

### Investigate Different Canyons 10 minutes

Display the four photographs of canyons from around the world (Lesson 18 Resource A), and ask students to examine the photographs and individually complete the comparison chart in their Science Logbooks (Lesson 18 Activity Guide B). 



#### Differentiation

If students confuse the terms *features* and *processes* in this lesson or in Lessons 19–20, consider using a T-chart to help distinguish differences in the terms. Showing students features on a globe or relief map may also be helpful.



#### Teacher Note

When revisiting this chart later in the lesson to summarize evidence gathered from investigations, model for students how to reevaluate claims considering new evidence and eliminate any claims that the evidence no longer supports.



#### Extension

To explore in more depth, allow students to find and investigate these canyons from around the world by using the Google Earth™ mapping service.



Yarlung Zangbo Grand Canyon, Tibet



Colca Canyon, Peru



Fish River Canyon, Namibia



Grand Canyon, United States

Organize students into small groups and allow them time to discuss their comparison charts. Ask each group to share one similarity or one difference they notice in the photographs. Students can add to their charts as they hear ideas they might have missed.

Sample comparison chart:

What is similar about all four canyons?			
<p>All the canyons are deep.</p> <p>All the canyons have rivers running through them.</p>			
What is different about the four canyons?			
Yarlung Zangbo Grand Canyon, Tibet	Colca Canyon, Peru	Fish River Canyon, Namibia	Grand Canyon, United States
<i>Big, snowy mountains are in the distance.</i>	<i>Some mountains are all around the canyon.</i>	<i>I don't see any mountains in the picture.</i>	<i>I don't see any mountains in the picture.</i>
<i>The rock walls are all the same color and don't look like layers.</i>	<i>I can't see a lot of the rock walls, but the ones I can see all look kind of gray.</i>	<i>The different-colored layers in the rock walls are lighter than the ones in the US Grand Canyon.</i>	<i>The layers in the rock walls are different colors. They are more red than the ones in Fish River Canyon.</i>
<i>A few plants are growing around and inside the canyon. Some are green, and some are brown.</i>	<i>Plants are growing all around the canyon. The photograph shows a lot of green.</i>	<i>I don't see any plants in the picture.</i>	<i>A couple of plants are around the top of the canyon. No plants are inside the canyon.</i>

Have students add evidence to the claims chart in their Science Logbooks (Lesson 18 Activity Guide A) based on the patterns they identify in their comparison chart. 🗨️ Discuss whether the evidence supports or refutes their claim, and update the class claims chart.



### Spotlight on Knowledge and Skills

Help students understand that patterns are an important form of evidence to consider as they construct and support explanations that describe and predict phenomena.

Sample class claims chart:

<b>Canyon Formation</b>	
Phenomenon Question: How do natural features and processes affect canyon formation?	
<b>Claim</b>	<b>Investigation Ideas</b>
<ul style="list-style-type: none"> <li>Rivers cause canyons to form by weathering rock layers over time and eroding the sediment.</li> </ul>	<ul style="list-style-type: none"> <li>Research canyons in other parts of the world.</li> <li>Look for canyons around the world to see whether they have a river at the bottom.</li> <li>Look at maps to see what else is around other canyons.</li> </ul>
<b>Evidence</b>	
<ul style="list-style-type: none"> <li>All four canyons we looked at have a river at the bottom.</li> </ul>	

## Interpret a Relief Map 15 minutes

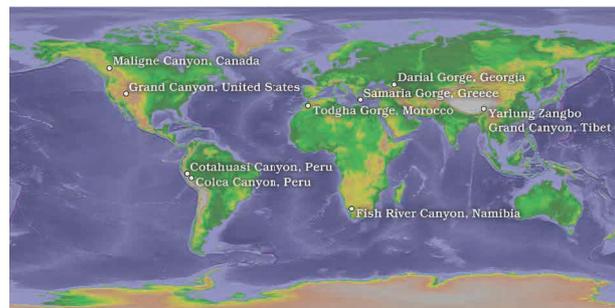
Point out that students were unable to tell from the photographs whether two of the canyons are near mountains.

- ▶ **What tool can we use to see whether mountains are near the canyons?**
  - We can use a map to see whether mountains are near the canyons.

Tell students they will use a map to examine the locations of canyons around the world and compare area features. The map shows the locations of the four canyons they looked at earlier in the lesson as well as some other large canyons.

Display the world relief map (Lesson 18 Resource B) at the front of the room. 

- ▶ **What do you notice about this map?**
  - It's a map of the world.
  - It doesn't look flat because of all the different shades of colors.



### Teacher Note

If a raised relief map or globe is available, consider displaying or sharing with students to allow them to feel the raised mountain ranges.

- *I see a lot of blue and green with some yellow and red. I think the blue is water and the rest is land.*
- *There are black dots with the names of the canyons we just looked at as well as the names of some other canyons.*

Tell students the map they are looking at is called a **relief map**. Use students' responses to discuss the anatomy of a relief map. 

- ▶ **Relief maps show raised land features (i.e., elevation above sea level).**
- ▶ **Areas with yellow, red, and white coloring show high elevation, where there are mountains or groups of mountains, called **mountain ranges** or mountain chains.**



### English Language Development

This module uses the terms *relief map* and *mountain ranges*. Introduce these terms explicitly. Sharing the Spanish cognate for *mountain* (*montaña*) may be useful. Additionally, students may benefit from examining more images of relief maps.

Students should follow along in their Science Logbooks (Lesson 18 Activity Guide C) to label and identify features on the map by using the steps below.  Assist students by pointing out the location of the school's city and state on the map.

- Use a bright color to draw a dot where you live and label it with your city and state names.
- Label north, south, east, and west on the top, bottom, and sides of the map.
- Use a different color to circle the mountains on continents.

Guide a discussion by using the following questions:

- ▶ **What does the map show about the location of canyons and mountains?**
  - *Most canyons on the map are where there is high elevation.*
  - *Most of the canyons are in red, yellow, or white areas.*
  - *Most canyons are near mountain ranges.*



### Teacher Note

In this relief map, color indicates elevation. Green indicates the lowest elevation, whereas yellow, red, and white indicate increasingly higher elevations. Consider finding a textured relief map for students who may benefit from feeling the bumpy areas that represent elevation.



### Teacher Note

Display the color version of the world relief map (Lesson 18 Resource B) during this activity for student reference. Consider making color copies of the map for students to label so they can see elevation changes more easily.

► **What point(s) can we add to our claim? What evidence supports that point?**

- *We can add the point that canyons are often near mountain ranges. Our evidence for this is that when we compare the locations of canyons and mountain ranges, they are usually near each other.*

Update the class claims chart, and have students update their claims chart in their Science Logbooks (Lesson 18 Activity Guide A).

Sample class claims chart:

<b>Canyon Formation</b>	
Phenomenon Question: How do natural features and processes affect canyon formation?	
<p style="text-align: center;"><b>Claim</b></p> <ul style="list-style-type: none"> <li>▪ <i>Rivers cause canyons to form by weathering rock layers over time and eroding the sediment.</i></li> <li>▪ <i>Canyons are often near mountain ranges.</i></li> </ul>	<p style="text-align: center;"><b>Investigation Ideas</b></p> <ul style="list-style-type: none"> <li>▪ <i>Research canyons in other parts of the world.</i></li> <li>▪ <i>Look for canyons around the world to see whether they have a river at the bottom.</i></li> <li>▪ <i>Look at maps to see what else is around other canyons.</i></li> </ul>
<p style="text-align: center;"><b>Evidence</b></p> <ul style="list-style-type: none"> <li>▪ <i>All four canyons we looked at have a river at the bottom.</i></li> <li>▪ <i>Most of the canyons on the world relief map are near mountain ranges.</i></li> </ul>	

## Organize Knowledge about Earth’s Features and Processes 10 minutes

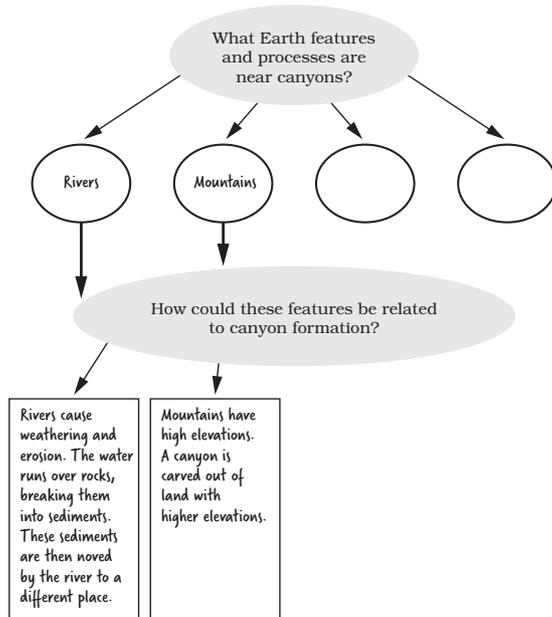
Have students look at their investigations from earlier in the lesson (Lesson 18 Activity Guides A, B, and C) and discuss with a partner what features the canyons have in common. Students should identify Earth features (i.e., rivers, mountains) from the investigations and consider how they could be related to canyon formation. Students should record their ideas in the natural features organizer in their Science Logbooks (Lesson 18 Activity Guide D). 



### Teacher Note

It is not necessary to discuss the processes that form mountains. Instead, focus on the idea that Earth’s surface changes constantly. Mountains take millions of years to form.

Sample natural features organizer:



After a few minutes, ask students to share their conclusions and how they organized the information in their natural features organizer. 

Note any conclusions students generate that do not support their claims about the Concept 3

Focus Question: **How do canyons around the world form?** Through class discussion, redirect students toward evidence that relates to their claims. Guide students to understand that although numerous observations can be made during an investigation, not all of them are necessarily useful in evaluating a claim.



**Differentiation**

Consider using this discussion to generate a class natural features organizer (1C).



### Check for Understanding

As students revisit the information they observed in the photographs and the world relief map, listen to their conversations and read the answers on their natural features organizers.

#### Evidence

Look for evidence that all students

- use prior knowledge about weathering and erosion to help form their answers,
- accurately interpret evidence of the relationship between rivers and canyons (e.g., all the canyons investigated in the lesson have a river at the bottom, rivers help form canyons because the moving water weathers rock and moves sediments to another place), and
- accurately interpret evidence of the relationship among mountains, rivers, and canyons (e.g., canyons are often near mountain ranges and are carved out of land with high elevations, mountains have high elevations and could be weathered by rivers, and the weathered sediments could be carried away by rivers to form canyons).

#### Next Steps

If students are struggling to pull out the correct information, interrupt student discussions and quickly debrief each investigation again or revisit the images to reset students' focus.

Pay attention to any group that has organized the information in a logical manner, and be sure to call on that group during the class discussion to guide the conversation in the intended direction.

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## Land 3 minutes

- ▶ When you look at the world relief map, what patterns do you notice in the locations of mountain ranges?

- *Some mountains are near the edges of continents.*
- *Some mountains are in the middle of continents.*
- *The canyons we looked at are near mountains.*

Build on students' observations to introduce the possibility that other features might also occur in global patterns that relate to canyon location. Share the next Phenomenon Question: **How can people use global patterns of Earth's features and processes to predict canyon location?**

