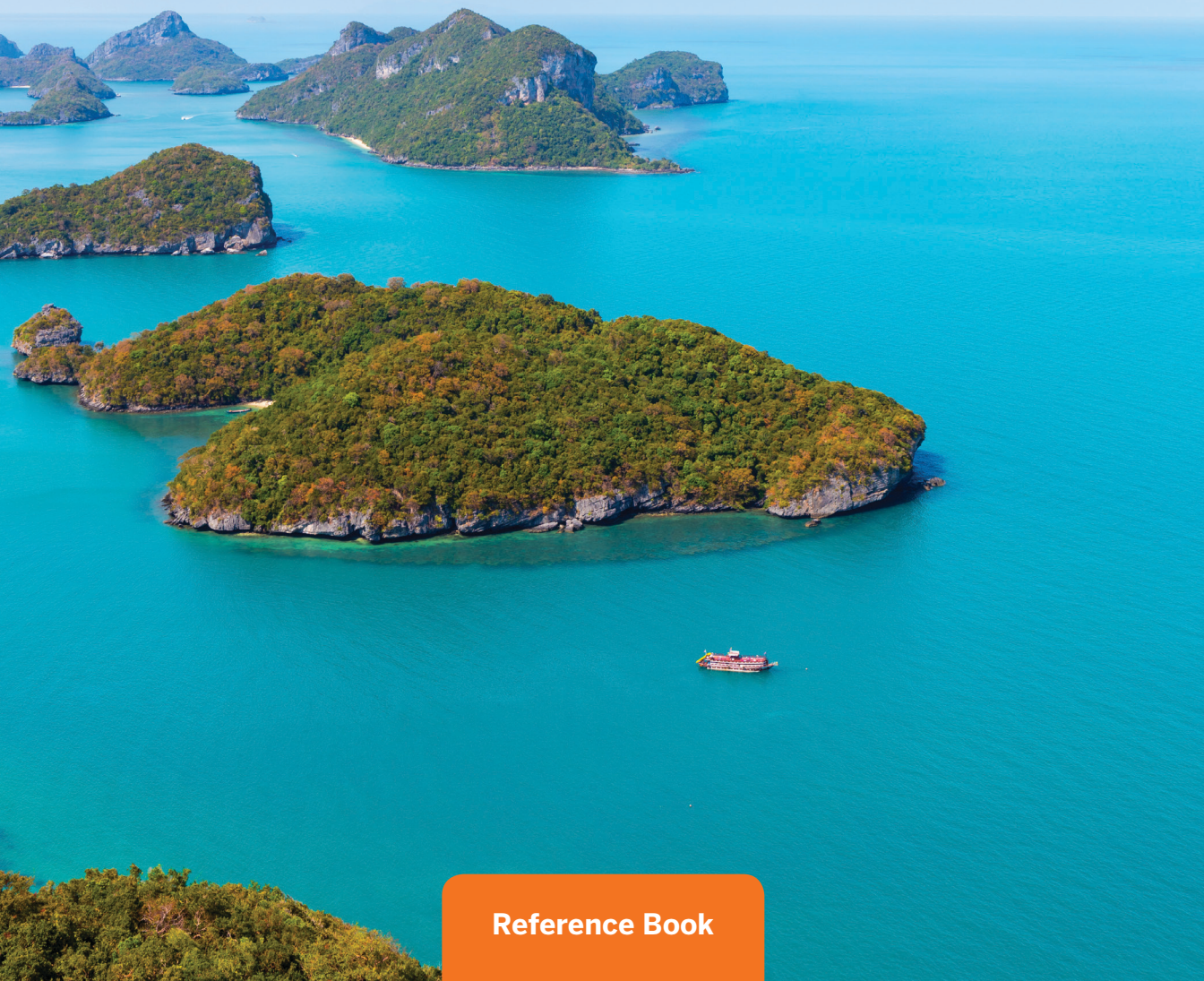


AmplifyScience

Handbook of Land and Water

by Ashley Chase



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Handbook of Land and Water

by Ashley Chase





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Contents

Earth's Surface.....	4
What Does It Look Like on a Map?.....	5
Landforms and Bodies of Water.....	10
Beaches.....	11
Caves.....	15
Islands.....	19
Lakes and Ponds.....	23
Mountains.....	27
Ocean.....	31
Rivers and Streams.....	35
Valleys and Canyons.....	39
Waterfalls.....	43
Glossary.....	47
Index.....	48



Earth's Surface

Astronauts took this photo of Earth. They were in space. They looked down at Earth's **surface**. From space, a lot of Earth looks blue. That's because water covers so much of Earth's surface. The white streaks you can see are clouds. You can also see lots of land.

This is a book about land and water on Earth. Read this book to learn about many different **landforms** and bodies of water. You'll read about mountains, lakes, islands, and more.



What Does It Look Like on a Map?

Here are some tall mountains near the water. What would this place look like on a map?

In order to **visualize** what it would look like, imagine you are a bird. Fly up higher and higher. Fly over the mountains and the water so that you can look down on them from above.

To get a better idea of what the mountains and the water look like on a map, keep flying higher and higher. In order to visualize this, you need to fly all the way into space!

Here is a photo that was taken looking down at Earth from space. It shows the same mountains that were in the picture on page 5. Even from up in space, you can see the white snow on the mountains. You can see the blue water around the land.



This photo was taken from a spacecraft looking down at Earth. It shows the Olympic Mountains.

Here is a map of those same mountains. A map is not a photo. It is a picture people create. A map shows the land and water in simple ways. Sometimes the colors are different on a map than they are in real life. This makes things easier to see and find. Most maps have something called a key or a legend. A map key is a guide to the map. It helps you figure out what each part of the map shows.

Map of the Olympic Mountains



Map key (legend)

● very high land

● low land

● cities and towns

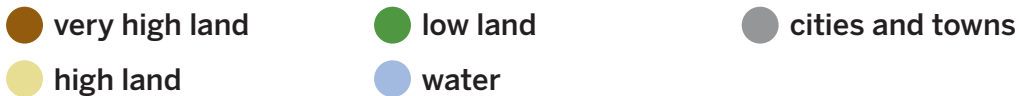
● high land

● water

Map of the Olympic Mountains



Map key (legend)



On the last few pages, we looked at a photo and visualized what that place would look like on a map. Now let's go the other direction. Look at the red mark on the map. Can you visualize what it would be like to stand in the place where the mark is? Would you be on the land or in the water? What would you see?



Landforms and Bodies of Water

Scientists who study Earth's **surface** are called **geologists**. Earth's surface may seem **stable**, but it is actually changing all the time. The **landforms** and bodies of water on Earth's surface are always changing. Mostly these changes happen slowly, but sometimes they happen fast. The rest of this book shows examples of landforms and bodies of water.

Landforms



page 11



page 15



page 19



page 27



page 39

Bodies of Water



page 23



page 31



page 35



page 43

Beaches

Beaches are **landforms** made up of loose **material**, such as sand, gravel, rocks, or mud. We find beaches where land meets a body of water. Beaches are usually on low land. The edge of the land is often called the coast.





Beach in South Carolina

Map of the South Carolina Coast



Map key (legend)

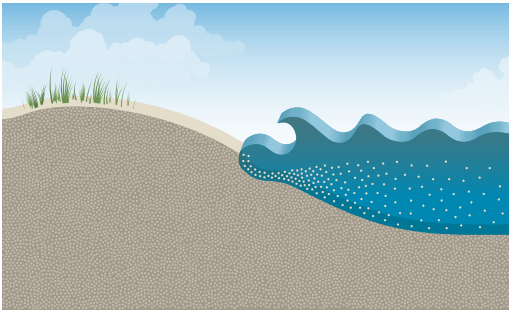
-  very high land
-  high land
-  low land
-  water
-  cities and towns

To find places on a map where beaches are likely to be, look for low land next to water.

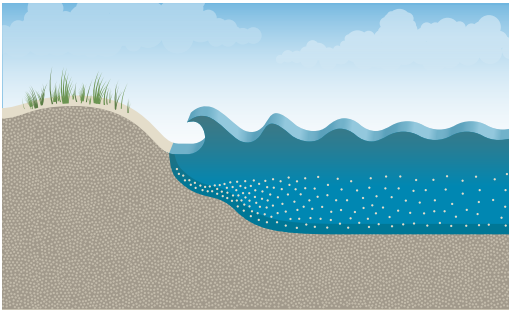
How Beaches Change Slowly

Beaches form because of **erosion**. Rivers and streams carry bits of rock (sand) down from mountains. The sand builds up slowly to form a beach.

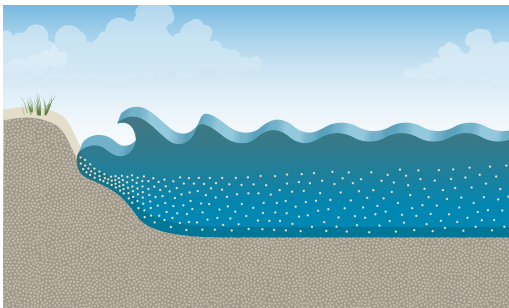
Erosion can also make beaches smaller. Waves hit the beach and carry sand away. The **diagram** below shows how this happens.



1. **Waves hit a beach. The waves erode the beach. Each wave carries away a little bit of sand.**



2. **As more and more waves carry sand away, the beach becomes smaller.**



3. **The little changes made by each wave add up to a big change.**

How Beaches Change Fast

Sometimes **erosion** happens quickly. Beaches are made of sand or other loose material, so they are not as **stable** as some other landforms. One storm can **erode** a beach fast because a lot of material can move at once. If storm waves and gusts of wind hit a beach with enough power, they can carry away huge amounts of sand in a single day.



beach before a storm



same beach after a big storm

Caves

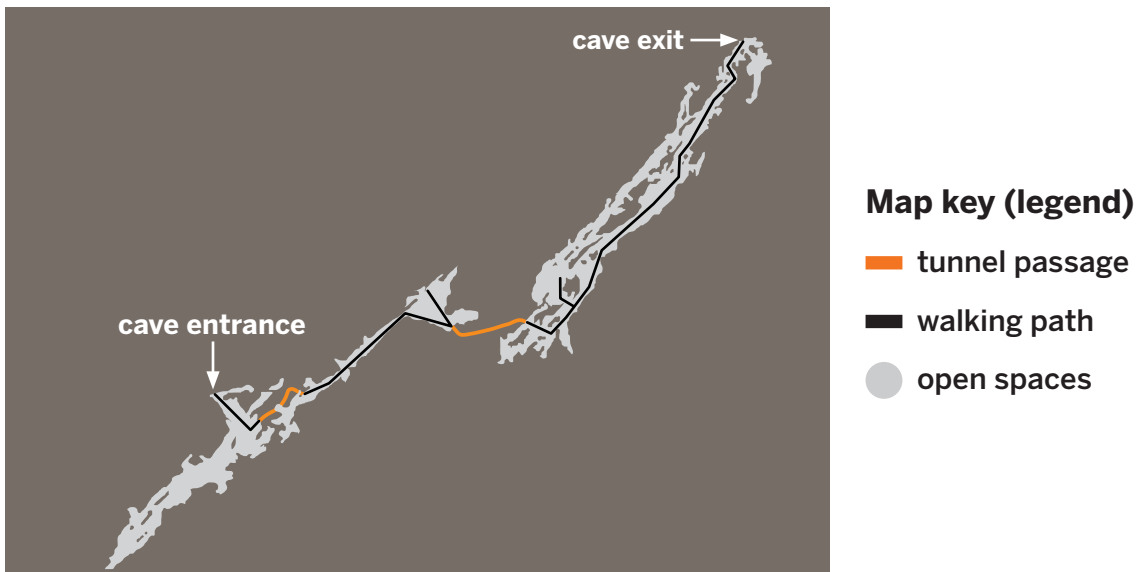
Caves are **landforms**, but they are not on Earth's **surface**. Caves are found underground! Caves are underground openings with walls of rock. Some caves have big spaces. Others are just narrow tunnels. Rocks in caves often have surprising shapes.





Timpanogos Cave

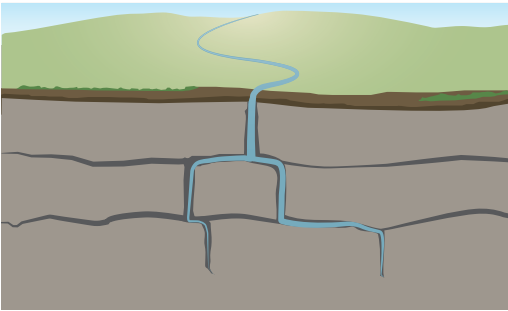
Map of Timpanogos Cave



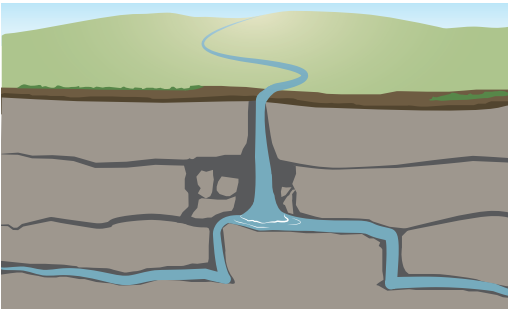
This cave map shows what it would look like if you could see through the ground to the cave below. It also shows the path where people walk through the cave. Sometimes the path goes through tunnels!

How Caves Change Slowly

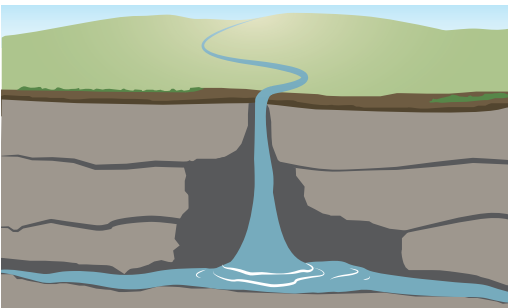
Caves form when water slowly **erodes** rock underground. Water seeps into cracks. The cracks become wider and wider, until a cave forms. Water only erodes a little bit of rock at a time. It takes a long time for caves to form—they do not form overnight. To learn more, see the **diagram** below.



1. Water seeps down through cracks in the rock.



2. As the water flows through the cracks, it erodes the rock. The water makes the cracks wider.



3. The water keeps eroding the rock. Over many years, the cracks get bigger and bigger to form open spaces inside the rock.

How Caves Change Fast

The roof of a cave may fall suddenly. This is called a cave-in. Cave-ins happen when rock is weak and cracked. The cracks make the cave less **stable**. Cave-ins can make new cave openings. They can also block cave tunnels. A cave-in changes a cave in seconds!



The roof of this cave fell in. You can see the new opening. The pieces of fallen rock are below.

Islands

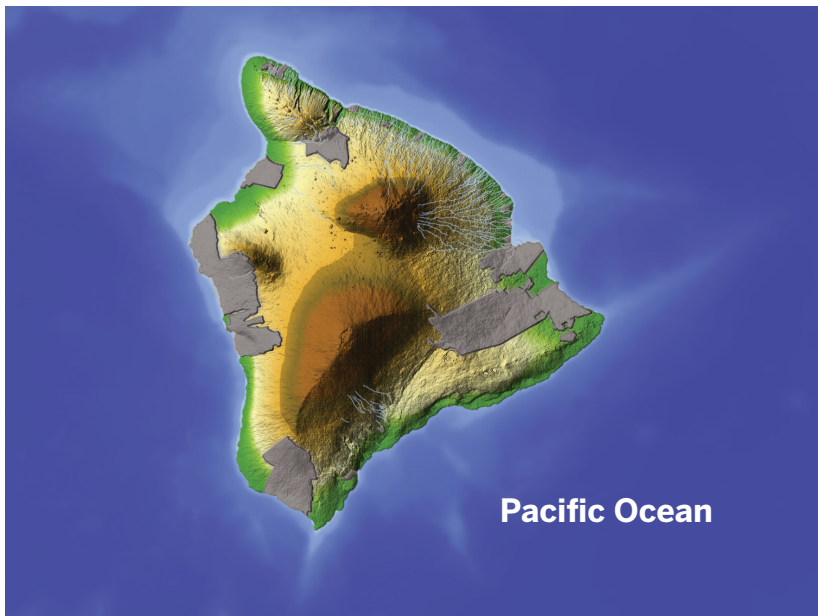
Islands are **landforms** with water all around them. Some islands are so big that it takes hours to drive from one side to the other. It can be hard to see the whole island at once. Other islands are so small that it's easy to see across them.





Hawaii Island

Map of Hawaii Island

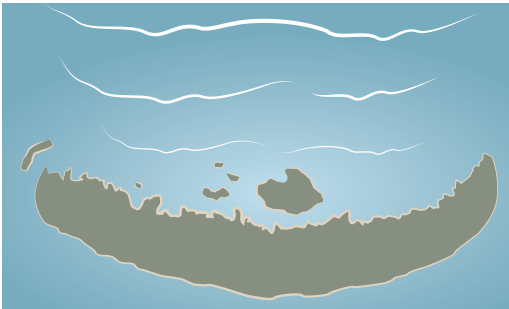


Map key (legend)

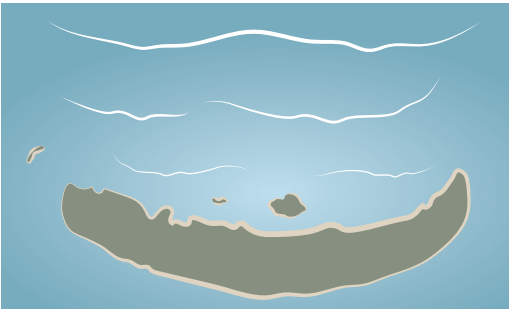
- very high land
- high land
- low land
- shallow water
- deep water
- cities and towns

How Islands Change Slowly

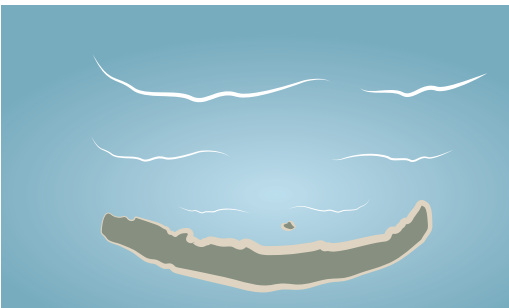
An island has water all around it, on every side. Water **erodes** the island all the time, slowly making it smaller. Water only erodes a little bit of the island at a time, so it is not possible to observe the island getting smaller within a day, or even a year. It takes many years for the change in size to become big enough to observe. You can see this in the **diagram** below.



1. **Waves crash on the shore of an island, carrying away sand. The waves erode the island.**



2. **Over time, waves carry away more and more sand, making the island smaller through erosion.**



3. **Over many years, the island continues to get smaller.**

How Islands Change Fast

Some islands are really the tops of volcanoes! Lava comes out of a volcano. The lava cools and hardens into rock. That rock becomes a new part of the island. A volcano can add rock to an island very quickly. It can add new land to the island within a day!



This picture shows hot lava flowing to the edge of an island. The lava will cool and harden into rock. This adds rock to the island fast!

Lakes and Ponds

Lakes and ponds are bodies of water. Most lakes and ponds are filled with freshwater (water that is not salty). Some have water that is even saltier than the ocean!

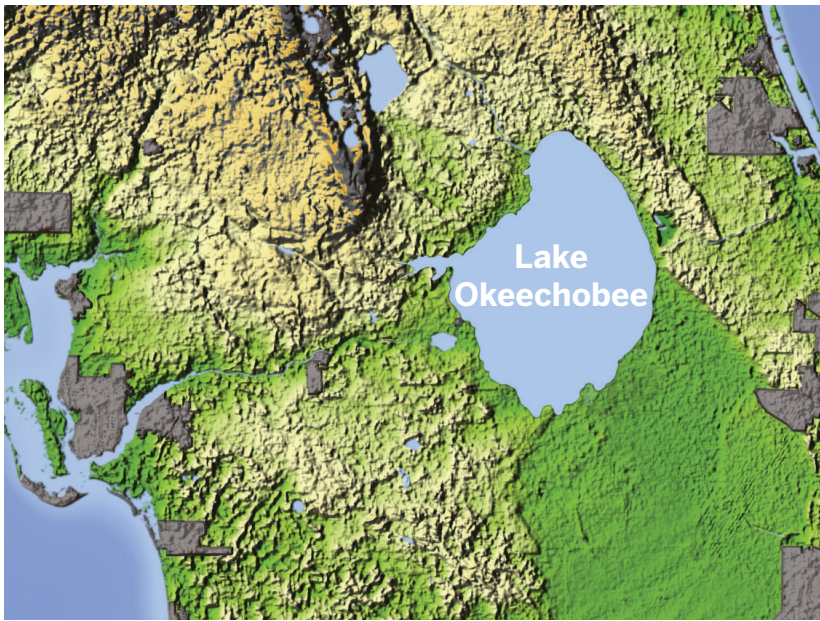
A pond is a body of water shallow enough for plants to grow on the bottom. Lakes are bigger and deeper than ponds. Lakes can be very deep.









Lake Okeechobee

Map of Lake Okeechobee

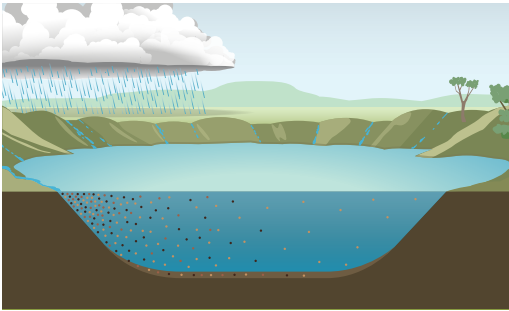


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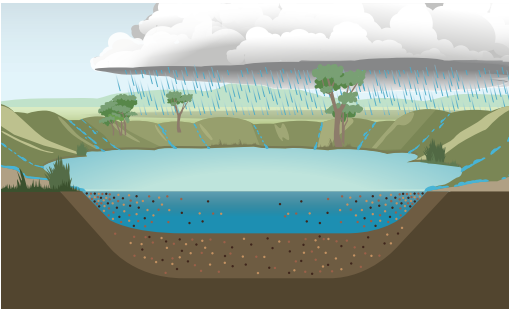
-  high land
-  low land
-  water
-  cities and towns

How Lakes Change Slowly

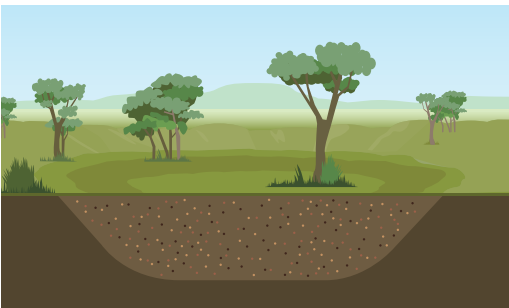
Lakes and ponds usually get smaller very slowly over time. Rainwater flows across the ground and carries tiny pieces of rock and sand into the lake. The pieces are too small to create an observable change within a day. However, over many, many years, the tiny pieces of rock and sand build up, slowly filling the lake. The **diagram** below shows how this happens.



- 1. Rainwater flows into a lake. This water contains tiny pieces of rock and sand.**



- 2. Over time, the tiny pieces of rock and sand can build up at the bottom of the lake. The lake becomes smaller.**



- 3. After many years, the pieces of rock and sand fill up the entire lake. Where the lake used to be, there is now land.**

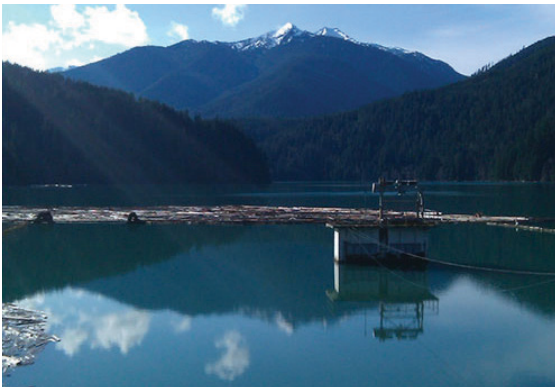
How Lakes Change Fast

Some lakes are made quickly by people. How do people make a lake? They build a big wall called a dam. The dam blocks water from a river, keeping it in one place. The water collects behind the dam, quickly forming a lake.

Sometimes, people decide to tear down an old dam. When they tear down the dam, the water flows out. This happens very quickly! The lake disappears. The water flows in a river again.



People made this lake by building a big wall called a dam.



This place had a lake because people built a dam.



This is the same place after people tore down the dam. The lake is gone.

Mountains

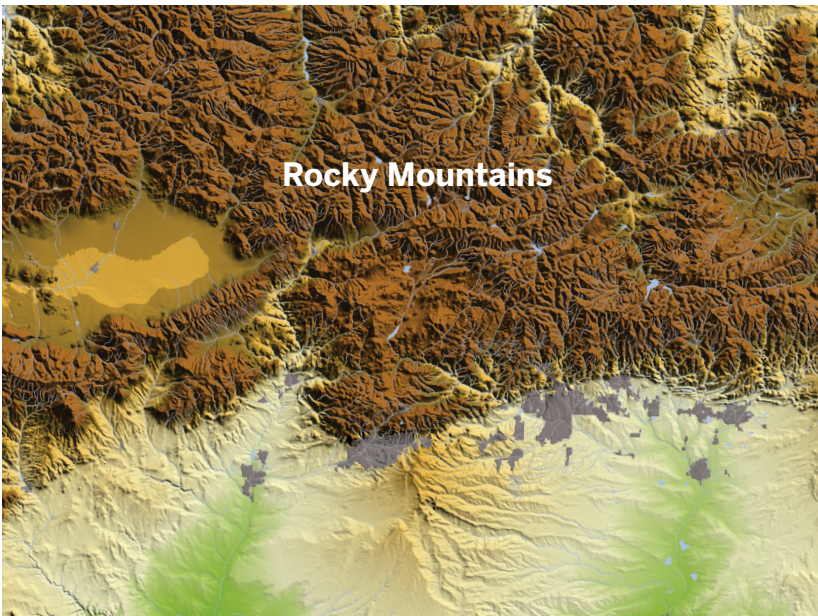
Mountains are big **landforms**. They are areas where the land is much higher than other areas. Mountains come in many shapes and sizes. Some mountains are jagged and stick up high above the land around them. Other mountains are low and rounded, and look like very large hills. Some mountains are volcanoes.





Rocky Mountains

Map of the Rocky Mountains in Colorado

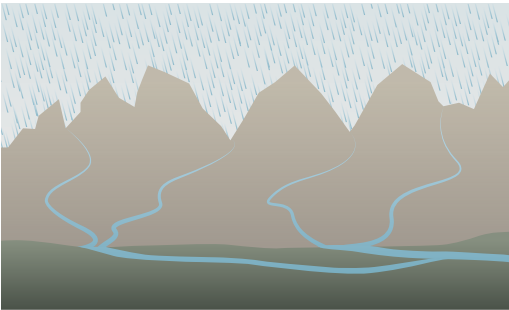


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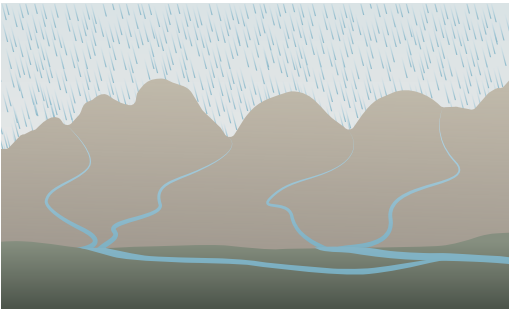
- very high land
- high land
- low land
- water
- cities and towns

How Mountains Change Slowly

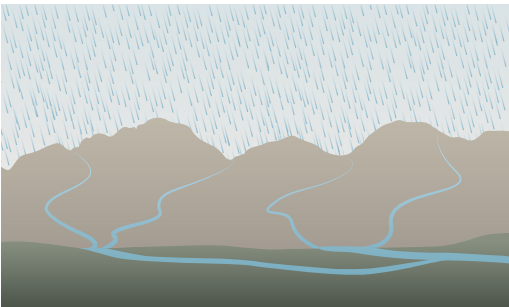
Mountains everywhere are slowly changing shape. Wind and water **erode** mountains, breaking off bits of rock and carrying them down the mountains. Over many, many years, **erosion** can change tall, jagged mountains into low, rounded mountains. It is impossible to observe the mountains getting smaller from a few tiny pieces of rock breaking off. However, the mountains keep losing little bits of rock all the time. To learn more, see the **diagram** below.



1. Rain falls on tall, jagged mountains. The rain erodes the mountains, breaking off tiny bits of rock. The water flows into streams and rivers.



2. Over time, rainwater, streams, and rivers break off many, many tiny bits of rock. Losing all those tiny bits of rock makes the mountains smaller.



3. After many years, erosion makes the mountains low and rounded.

How Mountains Change Fast

Usually, mountains **erode** very slowly. Every once in a while, **erosion** happens fast. For example, if part of a mountain is not **stable**, it can fall quickly in a landslide. In a landslide, gravel or other loose material slides down the side of a mountain. Landslides often happen during big rainstorms when a lot of water flows down a mountain and moves a lot of material all at once. When the rock that makes up a mountain is cracked, those cracks can make the mountain less stable. This makes landslides more likely.



Landslides change mountains quickly.

Ocean

The ocean is the largest body of water on Earth. It has different names in different places. There's the Atlantic Ocean, the Pacific Ocean, the Indian Ocean, and more. However, all of these are really part of one big body of water: Earth's ocean. Ocean water is salty.



Most of Earth's surface is covered by the ocean.



View of the Atlantic Ocean

Map of the Atlantic Ocean Off the Coast of North America

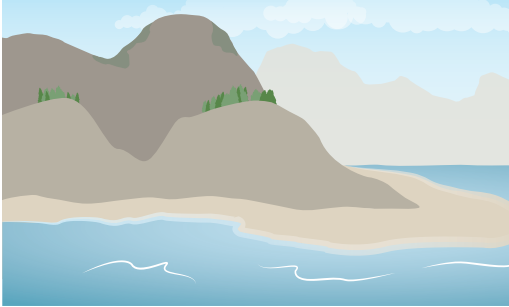


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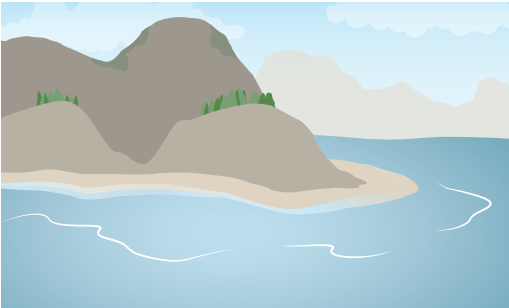
- land
- shallow water
- deep water
- cities and towns

How the Ocean Changes Slowly

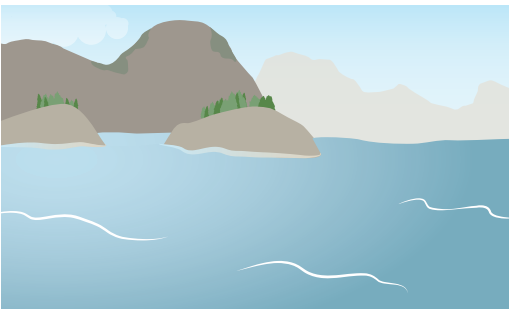
The water level of the ocean changes very slowly over time. In the past, the water level was lower than it is now. The water level is getting higher. As the water level rises, water covers more of the land. The **diagram** below shows how this happens.



1. Long ago, the ocean water level was lower than it is now.



2. Over time, the water level has been getting higher. Now water covers new parts of the land.



3. After many years, the water rises on all sides of some mountains, turning them into islands.

How the Ocean Changes Fast

You can see the ocean changing fast when the tide changes. At high tide, water comes up high on the land. At low tide, the water is low and you can see more of the land. In some places, the water level changes a lot in just a few hours.



At high tide, ocean water comes up high on these rocks.



These are the same rocks at low tide.

Rivers and Streams

Rivers and streams are flowing bodies of water. High up on hills and mountains, snow melts and rainwater falls. The water flows into streams. The streams flow downhill. Many streams come together to form a river. The river keeps flowing downward, usually all the way to the ocean.





Missouri River

Map of the Missouri River in North Dakota



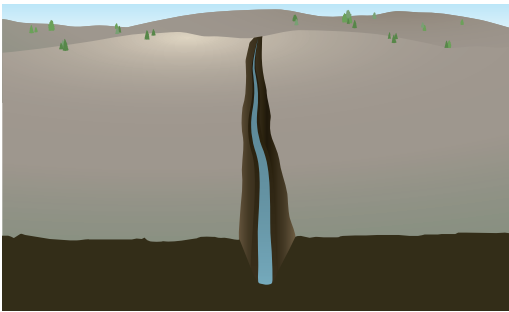
Map key (legend)

-  very high land
-  high land
-  low land
-  water
-  cities and towns

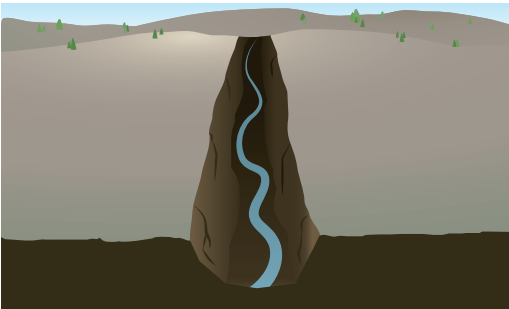
How Rivers Change Slowly

Rivers are always changing. As river water flows across the land, it **erodes** rock and soil away from some parts of the riverbed.

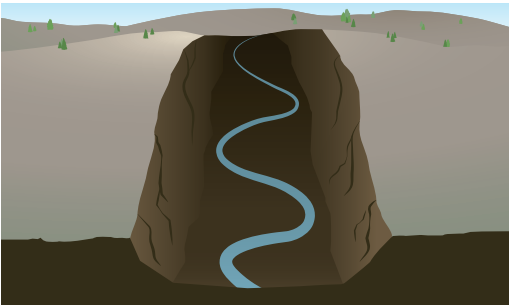
Erosion changes the shape of the river. Rivers tend to start out straight and become more curvy over time. We cannot observe the river changing shape within a day because the water only erodes a little bit of land at a time. However, over many, many years the shape can change a lot. See the **diagram** below to learn more.



1. As a river flows, it erodes the land. The water breaks off tiny bits of rock. The river carves out a narrow, straight valley. The sides of the valley are shaped like the letter V.



2. Over time, the river continues to erode the land, making the valley wider.



3. Over many years, erosion keeps making the valley wider. The river water begins to curve back and forth.

How Rivers Change Fast

Rivers can dry up suddenly. A river may dry up when there is not enough rain. In some cases, people use all the water in a river. People may use the river water for drinking, to water crops, or for other reasons. When people use all the water, the river water disappears before it reaches the ocean. All that is left is a dry riverbed.



This is a dry riverbed. A river used to flow here. Now the river has dried up.

Valleys and Canyons

Valleys are **landforms** with low land in the middle and higher land on the sides. Some valleys are mostly flat. Others are shaped like the letter V. Canyons are very narrow valleys with steep sides.

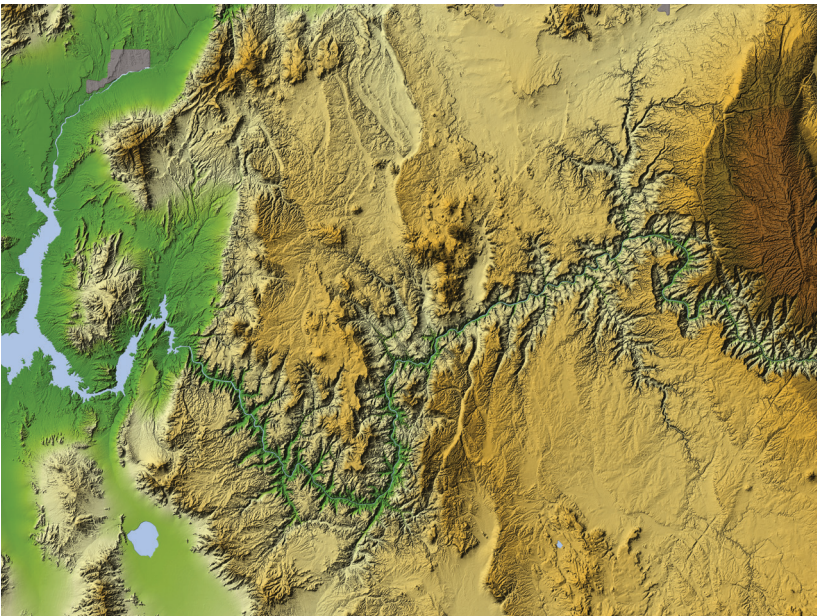
Many valleys are shaped by rivers **eroding** the land. Valleys can also be shaped by **glaciers**. Glaciers are like rivers of ice.





Grand Canyon

Map of the Grand Canyon

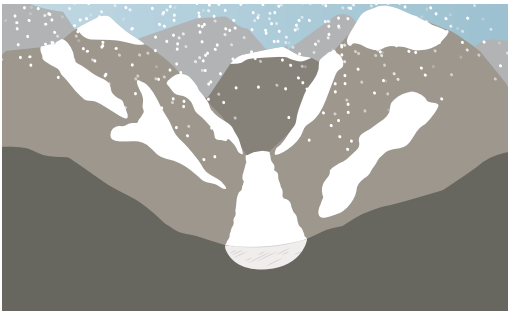


Map key (legend)

- very high land
- high land
- low land
- water
- cities and towns

How Valleys and Canyons Change Slowly

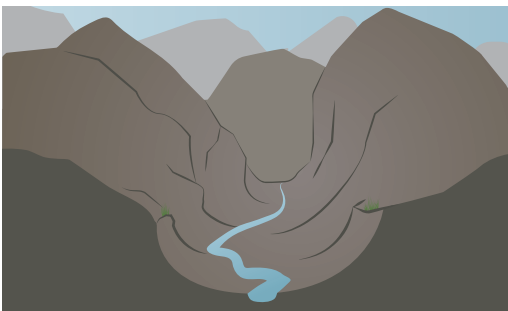
Valleys can be formed in different ways. Many valleys are formed by rivers. You can read about them on page 37. The **diagram** on this page shows how glaciers form valleys shaped like the letter U. It is impossible to observe the land changing shape from the small amount of rock that a glacier erodes in a day, a year, or even a lifetime! It takes many, many years for a glacier to create a valley.



1. **Snow falls high in the mountains. It is so cold up there that some of the snow doesn't melt. Over many years, the snow builds up and turns into solid ice. This is called a glacier.**



2. **Over time, the icy glacier becomes bigger and begins to move down the mountain. As the ice moves, it scrapes off bits of rock. The glacier carves a wide, valley shaped like the letter U.**



3. **When the glacier melts many years later, the U-shaped valley is left behind.**

How Valleys and Canyons Change Fast

Because parts of a valley can be made of loose sand and soil, a valley can change very quickly in a big flood. During a flood, more water flows through a river than usual. The water flows outside the banks of the river, flooding the land all around.

A flood can change the shape of a valley quickly by moving a lot of material. The parts of the valley that are made of loose sand and soil are less **stable**. In some parts of the valley, flood water may erode lots of sand and soil. The water carries the loose sand and soil away to other places and leaves them there. A flood may build up some parts of a valley and erode other parts.



A flood just happened in this small canyon. A geologist is taking measurements.

Waterfalls

Waterfalls are found where bodies of water flow over rock ledges. When a stream or a river comes to a ledge, the water falls over the ledge. We call that a waterfall. Waterfalls may be small or very, very large.





Niagara Falls

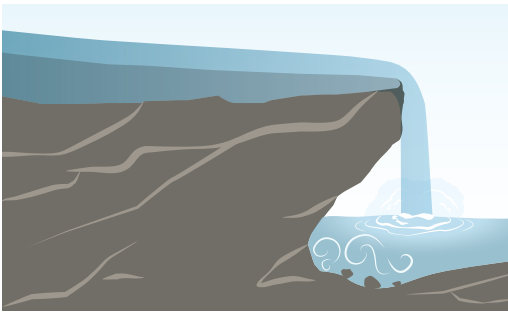
Map of Niagara Falls



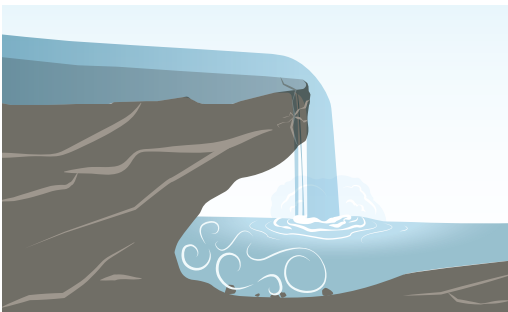
This waterfall map is different from the other maps in this book. It shows a much smaller area, and it is more like a drawing showing what the place looks like.

How Waterfalls Change Slowly

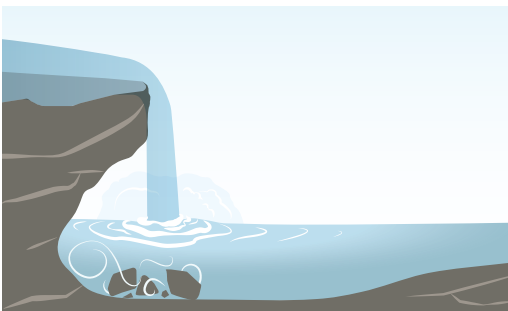
A waterfall doesn't stay in the same place forever. Over time, the water breaks tiny pieces off the rock ledge it flows over. The water erodes the rock ledge, moving it backward. The water does not erode enough rock to observe a change within a day. However, as it erodes more and more each day, very slowly, the whole waterfall moves backward. The **diagram** below shows how this happens.



1. A river flows over a rock ledge where high land meets low land. Where the water falls over the ledge, it forms a waterfall.



2. As it flows over the waterfall, water breaks off bits of rock and erodes the ledge.



3. Over many years, the water erodes the ledge more and more. As time goes on, the ledge ends up farther and farther back.

How Waterfalls Change Fast

The water that flows over a waterfall comes from rain or melting snow. When there is more rain or snow, more water flows over the waterfall. When there is less rain or snow, there is less water. A waterfall's flow may change from month to month, or even from day to day.



There is not much water flowing over this waterfall.



This is the same waterfall with more water flowing.

Glossary

diagram: an illustration that shows how something works or what its parts are

erode: to wear down rock, soil, or sand

erosion: when rock, soil, or sand is worn down and moved from one place to another

geologist: a scientist who studies the solid part of Earth

glacier: packed snow and ice that moves slowly, like a river of ice

landform: a feature of Earth's surface, such as a mountain, a cliff, or a valley

material: the stuff that makes up everything

stable: staying mostly the same

surface: the outside part of something

visualize: to make a picture in your mind using information from different sources

Index

Atlantic Ocean map 32

beaches 11–14

bodies of water 10, 23, 31, 35, 43

canyons 39–42

cave-ins 18

caves 15–18

dams 26

dry riverbeds 38

Earth from space 4, 6

erosion 13, 14, 17, 21, 29, 30, 37, 39, 41, 42, 45, 47

fast changes 14, 18, 22, 26, 30, 34, 38, 42, 46

floods 42

geologists 10, 42, 47

glaciers 39, 41

Grand Canyon map 40

Hawaii Island map 20

islands 19–22

Lake Okeechobee map 24

lakes 23–26

landforms 10, 11, 15, 19, 27, 39

landslides 30

maps 5–8, 12, 16, 20, 24, 28, 32, 36, 40, 44

mountains 27–30

Niagara Falls map 44

Olympic Mountains map 7, 8

ponds 23, 25

rivers 35–38

Rocky Mountains map 28

sand 11, 13, 14, 21, 25, 42

slow changes 13, 17, 21, 25, 29, 33, 37, 41, 45

storms 14

streams 35

tides (high tide and low tide) 34

Timpanogos Cave map 16

valleys 39–42

volcanoes 22, 27

waterfalls 43–46

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Changing Landforms

There's so much to learn about Earth's surface!

There are interesting landforms and bodies of water all around us. Use this reference book to find out what they are like and how they can change. You'll learn about mountains, rivers, caves, and more.



2

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