

Study Guide: Erosion and Weathering

Lesson 1: “Carving the Land”

You know that gravity causes water to flow downhill until it finds a low spot. Often a puddle that forms after a rainstorm is muddy because of the dirt it carried with it as it flowed. This process of soil moving from one spot to another happens all over the world all the time, even right now. It’s called **erosion**.

There are countless rocks on Earth’s surface and they are changing all the time. We don’t usually see them changing because these changes can happen very slowly. Rocks are made up of different minerals, and some of these minerals dissolve in water. When these minerals dissolve, the rock becomes weaker. Sometimes weak acids are made when water mixes with gases in the air. These acids can also make rocks weaker.

Rocks that have been weakened have holes and cracks. Water can get inside these cracks and freeze. When water freezes it expands, or gets bigger, which makes the crack bigger and more water can get in. This freezing and thawing over time will split the rock into smaller pieces. Seeds can also get inside these cracks. If a plant grows from the seed, the plant’s roots will also split the rock as it gets bigger. This process of rocks breaking into smaller pieces is called weathering.

Erosion is when rock and soil is broken into smaller pieces and moved from one place to another. Erosion is caused by moving water, wind, or moving ice in the form of glaciers. Water causes most of the erosion on Earth.

River systems like the Mississippi River system carry lots of **sediment**. As rivers flow downstream, the water wears away soil and rocks and over time river valleys can form. The water erodes the bottom of the valley, and eventually the soil above will cave in, making the valley deeper and wider. **Sediments** are the materials carried by moving water or wind, often soil and minerals.

When a river reaches an ocean, the water slows down and loses energy. When water slows down, it can’t carry all of its sediment anymore, and the sediment sinks. Over time, these sediments will build up at the mouth of the river forming a flat plain called a **delta**. A delta often has a triangular shape.

Erosion and weathering work together to shape Earth’s land. **River valleys** and **deltas** are just two ways that show it.

- **Erosion:** the process where rock and soil is broken down and moved from one place to another
 - **Weathering:** the process where rock is broken into smaller pieces. It is how sand is formed.
 - **Valley:** a low area between hills
 - **River System:** a river and all the waterways the flow into it
 - **River mouth:** where the river meets another body of water
 - **Delta:** a flat plain, often with a triangular shape, that forms as sediment builds up at the mouth of a river
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- The three major forces of erosion are **water, wind,** and moving ice called **glaciers**.
 - Erosion and weather shape and reshape Earth’s land.

Lesson 2: “The Changing Shoreline”

If you look at a globe or map of the world you’ll see that it is made mostly of water. The places where the oceans meet the land is called the **coastline** or **shoreline**. All of this coastline is under constant attack by water and wind. Moving wind and water cause most of the erosion on Earth, and the coastline is where the land is most open to moving water and wind.

Wind is what creates **waves**. As wind gets stronger, waves get bigger. Waves can grind sand and small rocks against larger rocks, which breaks down and wears away the rocks. This is how beach sand is created.

As waves rush away from the shore, they carry **sediment**. This sediment can be **deposited**, or left, in one place nearby or very far away. Sometimes sediment is carried hundred of miles away. There is usually more erosion in winter when waves are bigger and closer together. In summer, there is usually more deposition because the waves are smaller and gentler.

When sediment carried along the shoreline moves past a headland, the water slows down. Remember that when water slows, much of its sediment sinks. This causes the headland to grow out across the bay. This is how **barrier islands** are formed, like those that are found on the Atlantic and Gulf coasts of the United States.

Since the coastline is where most water and wind erosion occurs, and many people all over the world live in these coastal areas, people have created ways to slow down the process of erosion. **Jetties** and **sea walls** are two of the most common ways to do this. However, no matter how hard humans try, erosion and weathering will continue to occur.

- **Deposition:** the process where rocks and soil are left in a place
 - **Headland:** a natural piece of land that sticks out into the water, often at the mouth of a bay
 - **Bay:** a body of water partly surrounded by land
 - **Barrier island:** long, thin island formed as sediment is dropped when water flows along a headland
 - **Jetty:** a structure built to slow the process of erosion on the shore. Often a wall of large rocks that extends into the water, much like a headland.
 - **Sea wall:** a structure built along the shoreline to slow the process of erosion.
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- Moving water and wind are the major causes of weathering and erosion.
 - Wind creates ocean waves.

Lesson 3: “Sand Blasted”

You have probably seen sand or leaves blowing around on a windy day. This sand is sediment. Wind must blow at 11 miles per hour to carry sediment along the ground. Higher speeds are necessary to carry more sediment.

When soil is dry, it is more likely to be eroded by wind. In dry areas where few plants grow, wind erosion can be worse. Plant roots hold soil in place and prevent erosion. To slow the process of erosion on the coast, people build **jetties** and **sea walls**. To slow the process of wind erosion, people can build fences or plant shrubs or trees. These are called **windbreaks**. A dune fence is an example of a windbreak.

The sand carried by wind can weather Earth’s surface. As sand moves along the ground or against rocks, the sand can chip away at the rock, breaking it into smaller pieces. **Buttes** and other land formations can be formed as wind wears down and carries away bits of Earth’s surface.

Sediment is eroded from one spot and deposited in another. Over time, the sediment can build up when the wind slows down. Piles of sand deposited in one place are called **sand dunes**. Sand dunes can be found in the desert, on flood plains, and at the beach. They can be very tall (1,000 feet) and very large (the size of Texas!). Dunes can move in places where the wind flows steadily in the same direction, and may sometimes bury trees.

- **Windbreaks:** structures built to slow down wind erosion. High grass, shrubs, or trees can also act as windbreaks.
- **Sand dunes:** piles of sand deposited in one place by wind
- **Butte:** a narrow-topped hill with very steep sides
- **Sediment:** material carried by moving water or wind

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- Just as stronger water can carry more sediment, stronger wind can carry more sediment
 - Dry soil is more likely to be eroded by wind.
 - Plant roots help to hold soil in place and reduce wind erosion.

Lesson 4: “Glaciers: Nature’s Bulldozers”

Bulldozers are machines that can push soil, rocks, trees, and other material in front of it. **Glaciers** act like bulldozers, pushing material in front of them as they move across the surface of the Earth. A **glacier** is a huge mass of slow-moving ice that forms over land. Glaciers form in cold regions where a lot of snow falls in winter, but doesn’t melt too much in summer. The snow piles up and turns to ice. Some glaciers form in high mountain areas (**valley glaciers**) and others form only in Greenland and Antarctica (**continental glaciers**).

The force that causes glaciers to move is **gravity**. Continental glaciers are so large that their weight causes them to push outward in all directions. Like water, valley glaciers “flow” downhill. Some glaciers move a few inches a day, and others move a few feet. No matter how quickly a glacier moves however, it changes the surface of the Earth beneath it.

As the glacier moves across the Earth’s surface, it picks up rocks and soil like water and wind do. The sediment carried by a glacier is called **moraine**. When a glacier reaches its farthest point, where it begins to melt, it leaves a pile of soil and rock. This pile of rock at the end is called the glacier’s **terminal moraine**. Cape Cod and Long Island (New York) are the terminal moraine left behind by glaciers thousands of years ago.

There are many ways to tell if a glacier once covered an area, and these signs also give clues to how big the glacier was. Glaciers pick up rocks as they move across the ground, and these rocks carve out lines under the glacier called **glacier grooves**. When the glacier melts, the boulders it carried are left behind. These boulders are called **erratics**. Other hints that a glacier was once covering an area are U-shaped valleys, pointed mountain peaks, ridges, cliffs, lakes, and waterfalls. The Great Lakes were formed by glaciers. A **horn** is a pyramid-shaped mountain peak carved by glaciers. As valley glaciers move past the top of a mountain, it grinds bowl-shaped holes in the mountain, which creates the horn.

Although glaciers erode land more slowly than wind or water, their actions shape mountains and valleys, changing the shape of the Earth.

- **Glacier:** a huge mass of slowly moving ice that forms over land
 - **Continental glacier:** gigantic masses of ice that are found only in Greenland and Antarctica
 - **Valley glacier:** “rivers” of ice that form in high mountain areas
 - **Moraine:** rock material carried by a glacier (sediment)
 - **Terminal moraine:** the moraine deposited at a glacier’s farthest point
 - **Glacier grooves:** lines left on Earth’s surface as a glacier moves over it; give clues to how big the glacier was
 - **Erratics:** boulders dropped by a glacier as it melts
 - **Horn:** a pyramid-shaped mountain peak formed by a glacier
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- Continental glaciers are sometimes called “**ice sheets**.”
 - Valley glaciers are sometimes called “**alpine glaciers**.”
 - Signs a glacier once covered an area are U-shaped valleys, pointed peaks, narrow ridges, cliffs, lakes, and waterfalls.