Weathering, Erosion, and Deposition

Before You Read

What do you think? Read the two statements below and decide whether you agree or disagree with them. Place an A in the Before column if you agree with the statement or a D if you disagree. After you’ve read this lesson, reread the statements to see if you have changed your mind.

<table>
<thead>
<tr>
<th>Before</th>
<th>Statement</th>
<th>After</th>
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<tr>
<td></td>
<td>5. Rocks cannot change.</td>
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<td>6. Sediment can be transported by water, wind, and ice.</td>
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Weathering

You have read that mountains can form as a result of plate motion and volcanoes. But why don’t mountains last forever? Weathering refers to the processes that break down rocks, changing Earth’s surface over time. Erosion is the moving of weathered material, or sediment, from one location to another. Slowly but surely, weathering and erosion wear down mountains.

Physical Weathering

The process of breaking rock into small pieces without changing the composition of the rock is physical weathering. Physical weathering can be caused by temperature and by plants.

Temperature and Physical Weathering

Temperature is one factor that affects physical weathering. Most rocks contain water in cracks and spaces between the particles that make up the rock. During winter or at night, the water in rocks can freeze. When water freezes, it expands. If water in rocks freezes and melts repeatedly, it can break apart rocks. This is called frost wedging.

Plants and Physical Weathering

Plants also can cause physical weathering. For example, the roots of plants can grow into cracks in rock. As the roots grow and take up more space in the cracks, the force they apply to the rock breaks the rock.
Chemical Weathering

The process of changing the composition of rocks and minerals by exposure to water and the atmosphere is called **chemical weathering**. Some minerals chemically weather more easily than others. For example, calcite, the mineral that makes up limestone, dissolves readily in acidic rainwater. Feldspar, a common mineral in igneous rocks, easily weathers into the clay minerals, kaolinite. However, other minerals, such as quartz, are resistant to chemical weathering.

**Gases and Chemical Weathering** Gases in the atmosphere also can cause chemical weathering. Minerals containing iron react with oxygen in the atmosphere and form rust-colored minerals. Carbon dioxide in the atmosphere dissolves in water and makes acidic water. Limestone dissolves much faster in acidic water than in nonacidic water.

**Temperature and Chemical Weathering** Temperature also affects the rate of chemical weathering. You might know that chemical reactions happen faster at higher temperatures than at lower temperatures. That is why chemical weathering occurs fastest in hot, wet climates.

**Weathering Interactions**

Physical weathering exposes more surface area of rocks. This allows more water and atmospheric gases to enter rocks. Recall that water and gases help cause chemical weathering. Chemical weathering weakens rocks by changing the composition of some minerals and dissolving others. For example, clay formed by chemical weathering is weaker than the feldspar from which it formed. This weakening of rocks can increase the rate of physical weathering. In this way, chemical and physical weathering work together.

**Soil Formation**

Soil consists of weathered rock, mineral material, water, air, and organic matter from the remains of organisms. Soil forms directly on top of the rock layers from which it is made. The process of soil formation is illustrated in the figure at the top of the next page.

Soil formation takes a long time. It is the result of hundreds to thousands of years of weathering. The rock type that weathers, the biological activity, and the climate all affect soil formation.
Biological Activity and Soil Formation  Biological activity plays an important role in making soil. Tunnels formed by worms and other organisms form pathways in soil for water and air. Decaying plants and animals also produce carbon dioxide and other acids that enhance chemical weathering. Eventually, the decayed plants and animals become part of the soil and make it better for plant growth.

Climate and Soil Formation  Where do you think soil forms fastest? Soil forms fastest in warm, wet climates. Large amounts of rain can speed weathering of rocks. In addition, chemical reactions occur faster in warmer temperatures. Weathering also can happen quickly in areas where freezing and thawing break apart rocks.

Erosion  Weathering dissolves minerals and produces small particles of rock. *The minerals and small pieces of rock are called sediment.* What happens to sediment after it is made? The agents of erosion remove the sediment. Water, ice, and wind can transport sediment from one place to another.

Erosion by Water  Moving water causes erosion. The water picks up rock pieces and sediment. They then scrape along the ground, picking up more material. The faster the water flows, the larger the pieces of sediment the water can carry. Steep mountain streams carry away all sediment except large boulders. Water flowing in rivers as well as waves in lakes and oceans cause erosion.
Erosion by Ice

Glaciers are large masses of ice. As a glacier flows down a mountain, it removes rocks and sediment beneath it and along its sides. This forms a smooth land surface underneath the ice.

Erosion by glaciers makes deep valleys and steep peaks. Some glaciers can be large enough to cover continents. The ice covering Antarctica is an example.

Erosion by Wind

Strong winds also can erode and move sediment. Soil and rock that are not protected by plants can be eroded by wind. In some places, wind has eroded the rocks and made them look so smooth that they seem to have been sculpted by an artist.

Deposition

What happens to eroded sediment? Eventually, the moving water, ice, or wind slows down or stops. When this happens, the sediment is deposited. Deposition is the process of laying down eroded material in a new location.

Deposition by Water

Fast-flowing water carries sediment. If the speed of flowing water decreases, the water can no longer carry the sediment. The sediment will settle at the bottom of the water.

Floodplains form when sediment settles out of rivers that flood the areas next to them. The floodplain of the Hatchie River in Tennessee was formed in this way. Sediment also settles out of rivers where they enter lakes and oceans, forming deltas.

Deposition by Ice

When glaciers melt, the water produced by the melting ice does not flow fast enough to carry sediment. The sediment is deposited where the ice melts. Glacial deposits of sediment are called moraines.

Some moraines form mounds at the front and sides of glaciers. Other moraines can cover the ground that was previously under the glacier. When the glaciers that once covered much of North America melted, they left moraines over most of the areas where they melted.

Key Concept Check

6. Describe How does erosion change Earth’s surface?

7. Infer Why might farming be an important activity in river delta regions?

Reading Check

8. Define What is a moraine?
Deposition by Wind

Wind also can deposit sediment. Sand dunes are landforms made as wind continually moves and deposits sand grains. Wind moves the sand grains up one side of the sand dune and deposits them on the other side. Grain by grain, sand dunes migrate in the direction the wind blows.

The Erosion-Deposition Cycle

Weathering breaks rock into sediment that can be transported from high mountains to low areas. Sediment builds up on plains, at the bottom of lakes, and at the bottom of the ocean. Over time, thick layers of sediment form. The locations where sediment accumulates are called sedimentary basins. The Gulf of Mexico is a sedimentary basin into which the Mississippi River deposits sediment.

Recall that some minerals dissolve in water. If the water evaporates, the minerals form again. Over time, layers of salt can form in this way as water evaporates in sedimentary basins. The salt surrounding the Great Salt Lake in Utah is an example of minerals re-forming as water evaporates.

The cycle of weathering, erosion, and deposition has been repeated many times throughout Earth’s history. The cycle continues today. The shapes of continents change. The locations of plate boundaries change. Sediment continues to be deposited in low areas and then forced upward as tectonic activity forms mountains. Earth’s surface is continually changing.
**After You Read**

**Mini Glossary**

**chemical weathering:** the process of changing the composition of rocks and minerals by exposure to water and the atmosphere

**deposition:** the process of laying down eroded material in a new location

**erosion:** the moving of weathered material, or sediment, from one location to another

**physical weathering:** the process of breaking rock into small pieces without changing the composition of the rock

**sediment:** minerals and small pieces of rock produced by weathering

**soil:** consists of weathered rock, mineral material, water, air, and organic material from the remains of organisms

**weathering:** the processes that break down rocks, changing Earth’s surface over time

1. Review the terms and their definitions in the Mini Glossary. Write a sentence explaining the relationship between deposition and sediment.

2. Write the letters in the diagram to compare physical and chemical weathering.
   - a. affected by temperature
   - b. brought about by acid rain
   - c. affected by atmospheric gases
   - d. does not change composition of rocks
   - e. might break down mountains
   - f. changes composition of rocks
   - g. breaks down rocks
   - h. caused by plant roots
   - i. caused by frost wedging

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**What do you think NOW?**

Reread the statements at the beginning of the lesson. Fill in the After column with an A if you agree with the statement or a D if you disagree. Did you change your mind?

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