

Erosion and Deposition by Ice

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- What are glaciers?
- How do glaciers affect the landscape?

**National Science
Education Standards**
ES 1c, 2a

What Are Glaciers?

A **glacier** is a huge piece of moving ice. The ice in glaciers contains most of the fresh water on Earth. Glaciers are found on every continent except Australia.

There are two kinds of glaciers: continental and alpine. *Continental glaciers* are ice sheets that can spread across entire continents. *Alpine glaciers* are found on the tops of mountains. Both continental and alpine glaciers can greatly affect the landscape. ✓

Glaciers form in areas that are so cold that snow stays on the ground all year round. For example, glaciers are common in polar areas and on top of high mountains. In these areas, layers of snow build up year after year. Over time, the weight of the top layers pushes down on the lower layers. The lower layers change from snow to ice.

HOW GLACIERS MOVE

Glaciers can move in two ways: by sliding and by flowing. As more ice builds up on a slope, the glacier becomes heavier. The glacier can start to slide downhill, the way a skier slides downhill. Glaciers can also move by flowing. The solid ice in glaciers can move slowly, like soft putty or chewing gum.

Thick glaciers move faster than thin glaciers. Glaciers on steep slopes move faster than those on gentler slopes.



This is McBride Glacier in Alaska.



Compare As you read, make a table comparing the landforms that glaciers can produce.



1. Identify What are the two kinds of glaciers?

TAKE A LOOK

2. Define What is a glacier?

SECTION 3 Erosion and Deposition by Ice *continued*

Critical Thinking

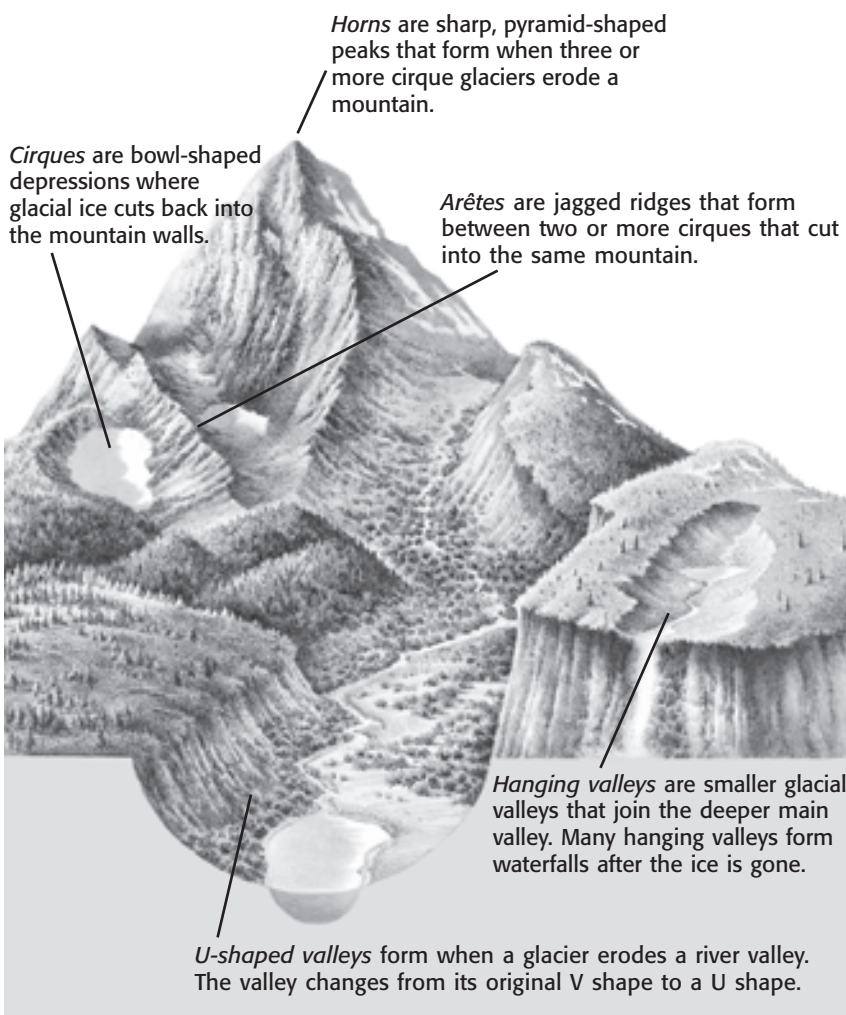
3. Identify Relationships

How is erosion by glaciers an example of water shaping the landscape?

How Do Glaciers Affect the Landscape?

Glaciers can produce many different features as they move over Earth’s surface. As a glacier moves, it can pick up and carry the rocks in its path. Glaciers can carry rocks of many different sizes, from dust all the way up to boulders. These rocks can scrape grooves into the land below the glacier as the glacier moves.

Continental glaciers tend to flatten the land that they pass over. However, alpine glaciers can produce sharp, rugged landscapes. The figure below shows some of the features that alpine glaciers can form.



TAKE A LOOK

4. Explain How are horns, cirques, and arêtes related?

GLACIAL DEPOSITS

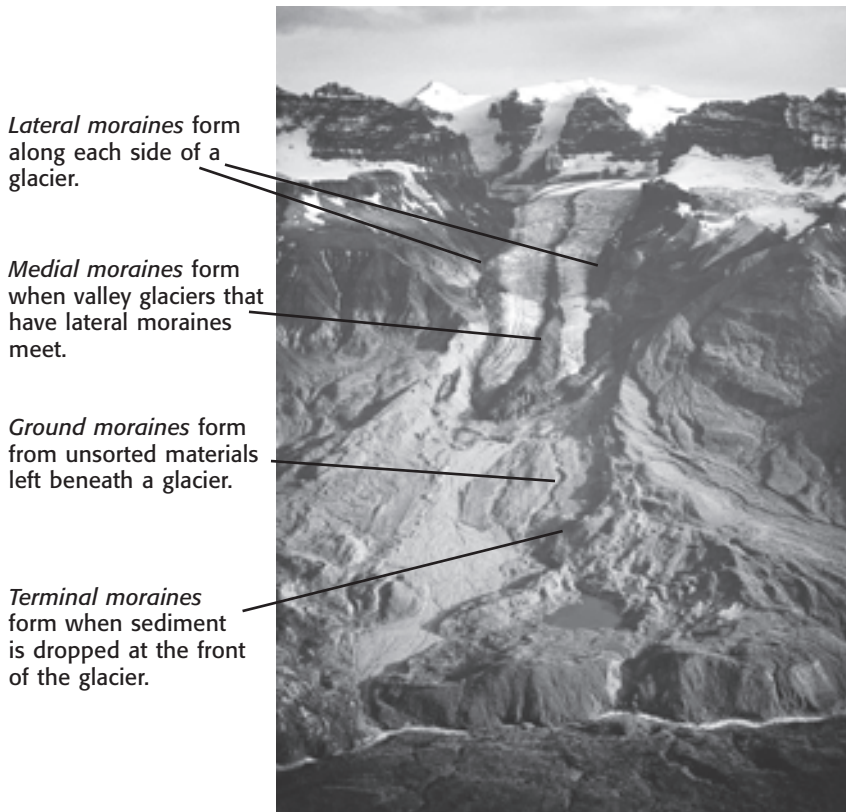
As a glacier melts, it drops all of the material that it is carrying. The material that is carried and deposited by glaciers is called **glacial drift**. There are two kinds of glacial drift: till and stratified drift.

SECTION 3 Erosion and Deposition by Ice *continued*

TILL DEPOSITS

Till is unsorted rock material that is deposited by melting glacial ice. It is called “unsorted” because the rocks are of all different sizes. Till contains fine sediment as well as large boulders. When the ice melts, it deposits this material onto the ground. ✓

The most common till deposits are *moraines*. Moraines form ridges along the edges of glaciers. There are many types of moraines. They are shown in the figure below.



✓ **READING CHECK**

5. Explain Why is till considered unsorted?

 **Say It**

Learn New Words Look up the words *lateral*, *medial*, and *terminal* in a dictionary. In a group, talk about why these words are used to describe different kinds of moraines.

STRATIFIED DRIFT

When a glacier melts, the water forms streams that carry rock material away from the glacier. The streams deposit the rocks in different places depending on their size. Larger rocks are deposited closer to the glacier. The rocks form a sorted deposit called **stratified drift**. The large area where the stratified drift is deposited is called an *outwash plain*. ✓

In some cases, a block of ice is left in the outwash plain as the glacier melts. As the ice melts, sediment builds up around it. The sediment forms a bowl-shaped feature called a *kettle*. Kettles can fill with water and become ponds or lakes.

✓ **READING CHECK**

6. Define Write your own definition for *stratified drift*.

Section 3 Review

NSES ES 1c, 2a

SECTION VOCABULARY

glacial drift the rock material carried and deposited by glaciers

glacier a large mass of moving ice

stratified drift a glacial deposit that has been sorted and layered by the action of streams or meltwater

till unsorted rock material that is deposited directly by a melting glacier

1. **List** Give two kinds of glacial drift.

2. **Identify** What are four kinds of moraines?

3. **Compare** How are continental glaciers different from alpine glaciers?

4. **Explain** How do glaciers form?

5. **Describe** How does a kettle form?

6. **Infer** How can a glacier deposit both unsorted and sorted material?

SECTION 3 EROSION AND DEPOSITION BY ICE

1. continental and alpine
2. a huge, moving sheet of ice
3. Glaciers are made of frozen water.
4. Horns and arêtes form when two or more cirques affect the same part of a mountain.
5. It contains particles of many different sizes.
6. Stratified drift is material that is deposited by water that comes from melting glaciers.

Review

1. till, stratified drift
2. lateral, medial, terminal, ground
3. Continental glaciers form on large areas of relatively flat land. Alpine glaciers form on top of high mountains.
4. Snow falls on an area but does not melt over the course of the year. Over time, more snow builds up in the area. The weight of the snow above pushes down on the snow below, causing the snow at the bottom to turn into ice. This ice is a glacier.
5. A block of ice is left behind as a glacier retreats. When the ice melts, the material in it gets deposited around the outside of the block. This makes a depression, called a kettle, in the center.
6. A glacier deposits unsorted material if, as it melts, the sediment in it drops to the ground. A glacier deposits sorted material if, as it melts, its water carries smaller sediment farther than larger sediment.

SECTION 4 THE EFFECT OF GRAVITY ON EROSION AND DEPOSITION

1. the steepest slope at which particles do not move downhill
2. The slope is greater than the angle of repose.

3. They can carry away, bury, and destroy habitats.
4. heavy, wet soil; removal of plant roots; earthquakes; construction
5. Water probably decreases the angle of repose, because wetting soil that is not moving can cause it to start moving downhill.
6. Creep happens slowly.

7.

Type of mass movement	Description
Landslide	Material moves suddenly and rapidly down a slope.
Rock fall	Loose rocks fall down a steep slope.
Mudflow	A large amount of mud moves downhill very quickly.
Lahar	Water mixes with volcanic ash to produce a fast-moving, dangerous mudflow.
Creep	Material moves downhill very slowly.

Review

1. landslides, mudflows, rock falls, creep, lahars
2. Mass movement can cause property damage and injury.
3. If the angle of a slope is greater than the angle of repose, mass movement will occur.
4. gravity
5. Landslides involve the fast movement of large amounts of materials of many different sizes. In mudflows, there is fast movement of mud only.
6. size, shape, weight, and composition of the particles making up the material