Section 1

Changing Earth's Surface

Reading Preview

Key Concepts

- What processes wear down and build up Earth's surface?
- What causes the different types of mass movement?

Key Terms

- erosion
- sediment
- deposition
- gravity
- mass movement

Target Reading Skill

Comparing and Contrasting As you read, compare and contrast the different types of mass movement by completing a table like the one below.

Mass Movement

Type of Mass Movement	Speed	Slope
Landslide		

Lab zone **Discover Activity**

How Does Gravity Affect Materials on a Slope?

1. Place a small board flat on your desk. Place a marble on the board and slowly tip one end of the board up slightly. Observe what happens.
2. Place a block of wood on the board. Slowly lift one end of the board and observe the result.
3. Next, cover the board and the wood block with sandpaper and repeat Step 2.

Think It Over

Developing Hypotheses How do the results of each step compare? Develop a hypothesis to explain the differences in your observations.

The ground you stand on is solid. But under certain conditions, solid earth can quickly change to thick, soupy mud. For example, high rains soaked into the soil and triggered the devastating mudflow in Figure 1. A river of mud raced down the mountainside, burying homes and cars. Several lives were lost. In moments, the mudflow moved a huge volume of soil mixed with water and rock downhill.

Wearing Down and Building Up

A mudflow is a spectacular example of erosion. **Erosion** is the process by which natural forces move weathered rock and soil from one place to another. You may have seen water carrying soil and gravel down a driveway after it rains. That's an example of erosion. A mudflow is a very rapid type of erosion. Other types of erosion move soil and rock more slowly. Gravity, running water, glaciers, waves, and wind are all causes, or agents, of erosion. In geology, an agent is a force or material that causes a change in Earth's surface.

FIGURE 1
Mudflow
A mudflow caused by heavy rains in San Bernardino, California, brought this ambulance to a stop.

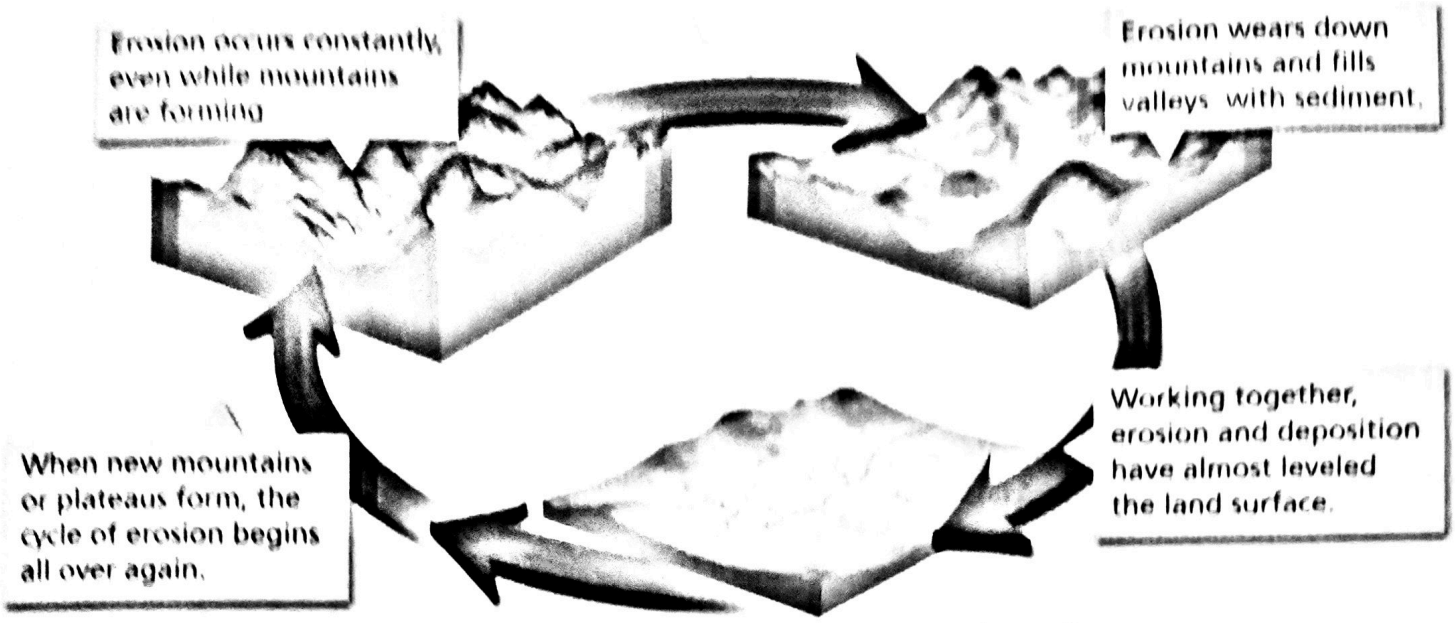


FIGURE 2
Cycle of Erosion and Deposition
Over millions of years, erosion gradually wears away mountains while deposition fills in valleys with sediment.
Predicting *What would happen to the surface of the land if uplift did not occur?*

The material moved by erosion is **sediment.** Sediment may consist of pieces of rock or soil or the remains of plants and animals. Both weathering and erosion produce sediment. **Deposition** occurs where the agents of erosion, deposit, or lay down, sediment. Deposition changes the shape of the land. You may have watched a playing child who picked up several toys, carried them across a room, and then put them down. This child was acting something like an agent of erosion and deposition.

Weathering, erosion, and deposition act together in a cycle that wears down and builds up Earth's surface. Erosion and deposition are at work everywhere on Earth. As a mountain wears down in one place, new landforms build up in other places. The cycle of erosion and deposition is never-ending.

Reading Checkpoint **What is sediment?**

Mass Movement

Imagine that you are sitting on a bicycle at the top of a hill. With only a slight push, you can coast down the hill. If the slope of the hill is very steep, you will reach a high speed before reaching the bottom. The force that pulls you and your bicycle downward is gravity. Gravity pulls everything toward the center of Earth.

Gravity is the force that moves rock and other materials downhill. Gravity causes **mass movement**, any one of several processes that move sediment downhill. **The different types of mass movement include landslides, mudflows, slump, and creep.** Mass movement can be rapid or slow.

Lab zone Skills Activity

Making Models

You can make a model of mass movement. Design a plan to model one of the types of mass movement using sand, pebbles, and water. With your teacher's approval, make and test your model.

How well did your model represent the type of mass movement you chose? How could you improve your model?

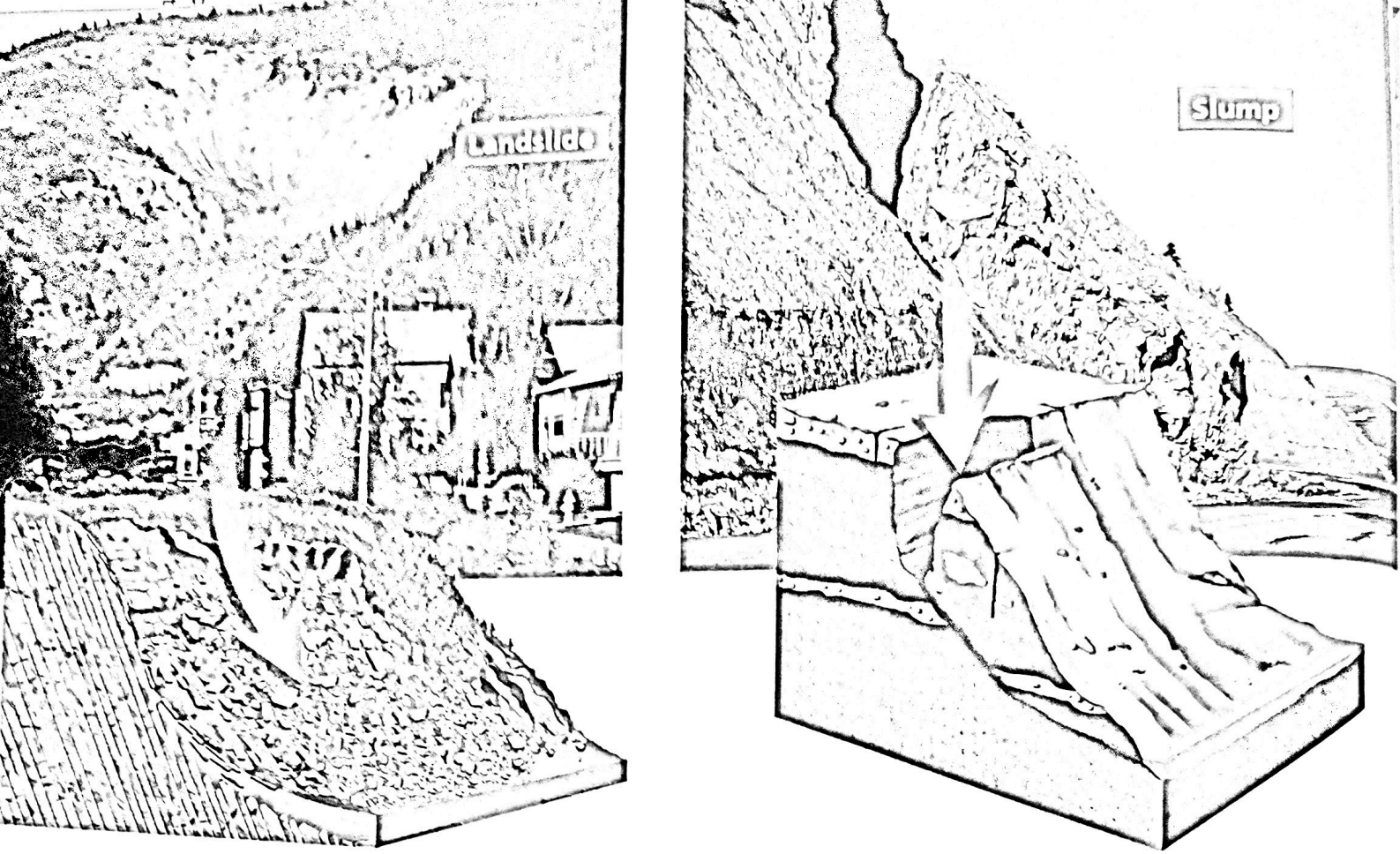
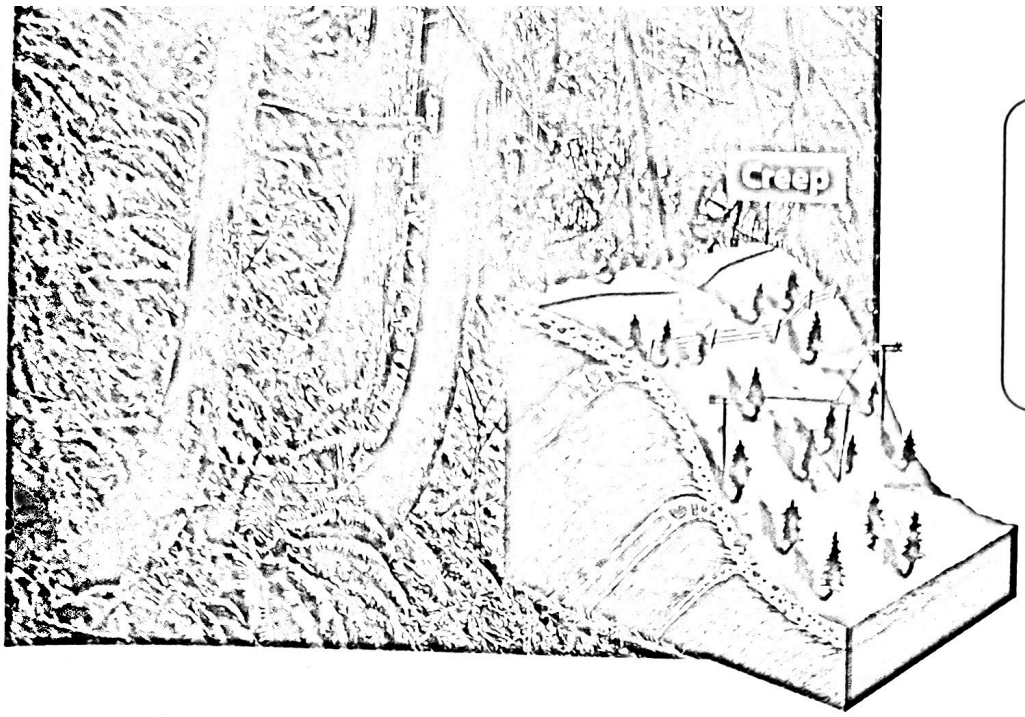


FIGURE 3
Mass Movement
In addition to mudflows, types of mass movement include landslides, slump, and creep.
Making Judgments *Which form of mass movement produces the most drastic change in the surface?*

Landslides The most destructive kind of mass movement is a landslide, which occurs when rock and soil slide quickly down a steep slope. Some landslides contain huge masses of rock. But many landslides contain only a small amount of rock and soil. Some landslides occur where road builders have cut highways through hills or mountains. Figure 3 shows an example of a landslide.

Mudflows A mudflow is the rapid downhill movement of a mixture of water, rock, and soil. The amount of water in a mudflow can be as high as 60 percent. Mudflows often occur after heavy rains in a normally dry area. In clay soils with a high water content, mudflows may occur even on very gentle slopes. Under certain conditions, clay soils suddenly turn to liquid and begin to flow. An earthquake can trigger both mudflows and landslides. Mudflows can be very dangerous.

Slump If you slump your shoulders, the entire upper part of your body drops down. In the type of mass movement known as slump, a mass of rock and soil suddenly slips down a slope. Unlike a landslide, the material in a slump moves down in one large mass. It looks as if someone pulled the bottom out from under part of the slope. A slump often occurs when water soaks the bottom of soil that is rich in clay.



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Creep Creep is the very slow downhill movement of rock and soil. It can even occur on gentle slopes. Creep often results from the freezing and thawing of water in cracked layers of rock beneath the soil. Like the movement of an hour hand on a clock, creep is so slow you can barely notice it. But you can see the effects of creep in objects such as telephone poles, gravestones, and fenceposts. Creep may tilt these objects at spooky angles. Landscapes affected by creep may have the eerie, out-of-kilter look of a funhouse in an amusement park.

Reading Checkpoint **What is the main difference between a slump and a landslide?**

Section 1 Assessment

Target Reading Skill Comparing and Contrasting Use the information in your table to help you answer Question 2 below.

Reviewing Key Concepts

1. a. **Listing** What are five agents of erosion?
   b. **Defining** In your own words, write a definition of *deposition.*
   c. **Predicting** Over time, how will erosion and deposition affect a mountain range? Explain.
2. a. **Listing** What are the four types of mass movement?
   b. **Relating Cause and Effect** What force causes all types of mass movement?
   c. **Inferring** A fence runs across a steep hillside. The fence is tilted downhill and forms a curve rather than a straight line. What can you infer happened to the fence? Explain.

Lab zone At-Home Activity

Evidence of Erosion After a rainstorm, take a walk with an adult family member around your neighborhood. Look for evidence of erosion. Try to find areas where there is loose soil, sand, gravel, or rock. **CAUTION:** *Stay away from any large pile of loose sand or soil—it may slide without warning.* Which areas have the most erosion? The least erosion? How does the slope of the ground affect the amount of erosion? Sketch or take photographs of the areas showing evidence of erosion.