

Hills of Sand

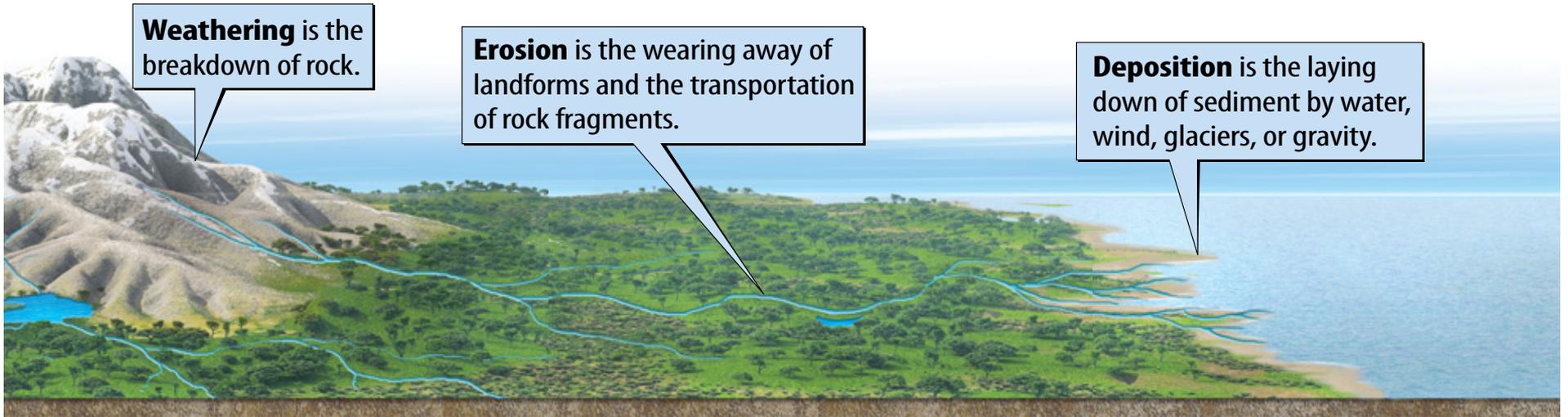
At the water's edge, sandy beaches can be as flat as a pancake. But farther inland, away from the crashing waves, the wind often blows beach sand into small hills called dunes.

Dunes help protect the beach, and they provide nesting grounds for sea turtles, birds, and other animals. But dunes are fragile. Laws have been passed to protect the dunes on many beaches.



- 1 Describe the dunes shown here. What does the appearance of the fence show about the dunes?
- 2 Why are dunes more fragile than other landforms?
- 3 Grasses often grow on dunes. How do grasses impact the dunes? Discuss.

Weathering, Erosion, and Deposition



Sea Stacks

Many intriguing landforms are found along coastlines. These rocky towers are called sea stacks. It might appear as though they were cut loose from the land and then drifted into the water.

In fact, the sea stacks formed from the repeated action of ocean waves. Over a few thousand years, pounding water broke apart and washed away the rock along the shore, creating the sea stacks.



- ❶ What clues in the photo suggest that the sea stacks were once connected to the cliffs on shore?
- ❷ What forces other than water might have affected the coastline during the past several thousand years?

Erosion by Longshore Current



Not an Ordinary Day

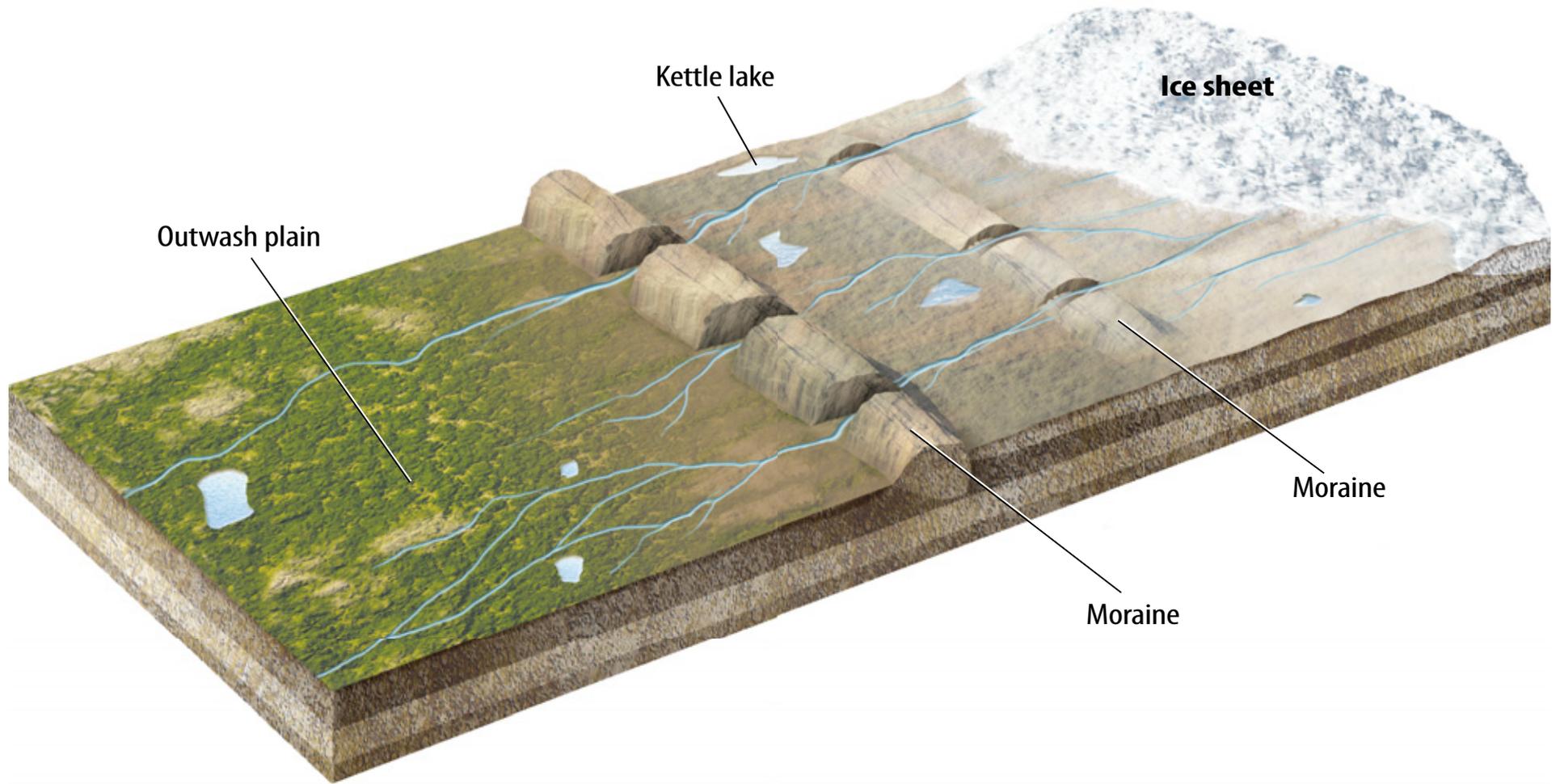
March 4, 1995, began as an ordinary day in La Conchita, California. But at 2:03 P.M. the land on the bluff above the town began moving. Within a few minutes, ten houses were buried under huge piles of rock and dirt.

Landslides can be triggered by earthquakes, heavy rainfall, or human activities. Then the force of gravity takes over. Earth's gravity pulls rocks downward, just as it pulls on everything else.

- 1 Look at the photo. What clues show that the land fell quickly and in large blocks?
- 2 How might the bluff have changed since 1995?
- 3 What are some other ways that gravity can affect landforms?



Glacial Deposition



Teacher Guide

Erosion and Deposition

Lesson 1 Bellringer

Tim McCabe/NRCS

Hills of Sand

- Sand dunes form along beaches as well as in sandy deserts. Dunes change constantly as the wind blows sand into and out of the dunes. Typically, winds blow sand into a gradual slope on the windward side of the dune. The other side of the dune, called the leeward side, is much steeper. The wind can slowly advance a dune, although grasses help hold the dune in place.
- Because dunes are so easily disrupted, students might be hesitant to consider them a landform.

Answers to Questions

- 1 The dunes are small hills made of white sand. Grass is growing on parts of the dunes. The fence shows that the dunes have shifted position over time. The fence likely affected the dunes' formation by blocking wind and sand.
- 2 Dunes are made of sand particles. They change frequently. Even a common and relatively weak force, such as a brisk breeze or an animal's footsteps, can alter a dune.
- 3 The roots of grasses help the sand in the dunes remain in place. The plants slow the wind and allow more sand to be deposited.

Lesson 1 Focus on Content

Weathering, Erosion, and Deposition

- Ask students to predict how weathering and erosion would change the mountains after thousands or millions of years. Gradually, as the jagged mountain peaks became rounder, the mountains would become shorter.
- Students might wonder why weathering and erosion have not yet flattened all of Earth's mountains, or they might wonder whether weather and erosion will flatten the mountains at some point in the future. Remind students that Earth's surface is also subject to forces that act to build mountains, such as the motion of tectonic plates.

Lesson 2 Bellringer

Stephen Reynolds

Sea Stacks

- A headland is a block of land that meets the ocean. Sea stacks often form from headlands that are a mixture of two or more rock types. The ocean erodes the less resistant rocks, leaving the more resistant rocks behind.

Answers to Questions

- 1 The sea stacks appear to have the same colors and horizontal bands as the cliffs on shore. In addition, the tallest sea stacks and the cliffs appear to be about the same height.
- 2 Answers include gravity, wind, and the motion of Earth's tectonic plates.

Lesson 2 Focus on Content

Erosion by Longshore Current

- Have students use the arrows to trace the movement of sand down this beach. Then ask what happens to the sand when it meets the jetty, which is the pier-like structure that extends into the water. Discuss how piers, jetties, and other human-made structures can interrupt the natural flow of sand along beaches.

Lesson 3 Bellringer

Photograph by R.L. Schuster, U.S. Geological Survey

Not an Ordinary Day

- The La Conchita landslide of 1995 is an example of slump—a landslide in which the material moves as a large mass. The slump was triggered by several months of abnormally heavy rains that loosened the soil, causing it to fall en masse down the steep slope. In 2005, another landslide occurred in the same location.

Answers to Questions

- 1 The falling land carried the plants growing on it. The debris appears to be a large mass of rock and dirt, not loose boulders.
- 2 Over time, new trees or other plants might have grown on the disrupted land. More rocks and soil might have fallen onto the houses.
- 3 Answers include individual rocks falling down mountains and hills, rivers carrying weathered rocks as they flow downhill, and sediment being deposited at the bottoms of rivers or along their banks.

Lesson 3 Focus on Content

Glacial Deposition

- Remind students that in the last ice age, glaciers covered all of Canada and much of the northern United States. Although the ice age ended thousands of years ago, its effects are still important today. Glacial deposition provided the characteristic rocky soil of New England and other northern states. Terminal moraines formed several islands off the coast of New England, including Martha's Vineyard, Nantucket, and Long Island.