CRUMBLING, TUMBLING, WASHING AWAY

Grade 5

Lesson at a Glance

Students experiment with the weathering of rocks and construct and erode small sand volcanoes to investigate the role of water in erosion.

Key Concepts

Weathering causes rock to decompose. The major source of erosion in Hawai'i is stream action; wave action is a secondary source.

Objectives

Students will be able to:

1) Demonstrate how streams transform the shape and size of a shield volcano through erosion.
2) Describe how weathering and erosion create valleys.

Time

two - three class periods

Subject Areas

science, language arts, Hawaiian studies

Materials

spray mist bottle
white vinegar or 10% hydrochloric acid (HCl) solution

one for each group of students:
- hand lens
- eyedropper or paper cup
- cup of water
- cup of sand
- small waterworn lava pebble
- a piece of chalk
- a plastic-coated plate
- newspaper

Preparation

Ask students to collect some waterworn lava pebbles and bring them to school. (Lava pebbles can be found at a stream or at the beach.) Use damp sand to build a small shield volcano on a plastic-coated plate and set it aside for a classroom demonstration.

Teacher Background

For students living on older islands, such as Kaua'i or O'ahu, it is difficult to imagine that a rounded shield-shaped volcano once existed where steep, jagged cliffs, canyons and deep valleys now stand. It is also difficult to visualize the former extent of the older volcanoes and to conceptualize the tremendous amount of material that has been lost to **erosion**.

Rocks exposed to the elements go through two types of weathering. **Mechanical weathering** is the physical disintegration of rock into smaller and smaller pieces. It is caused by the wedging action of growing plant roots and by freezing and thawing of water at high elevations. For example, in upper parts of Mauna Kea and Mauna Loa where temperatures drop below freezing nearly every night, water that falls into joints or cracks in rocks expands as it freezes and causes the rocks to split apart.

Chemical weathering is the **decomposition** of the original rock minerals. It occurs when rainwater and **carbon dioxide** from the air or soil produce **carbonic acid**. The carbonic acid dissolves minerals and causes the rocks to break down. Oxidation or rusting is another type of chemical weathering where iron combines with oxygen in air or water to form rust. Most decayed rocks and soils are various shades of brown due to the oxidation of iron-bearing minerals.

The **basalt** rock produced by Hawaiian volcanoes weathers very quickly in the tropics. Fragments of weathered rocks exposed to the force of running streams and crashing waves are carried away in the process of erosion. The major source of erosion in Hawai'i is stream action; wave action is a secondary source. In addition to wearing away sea cliffs, the action of waves breaks up coral, shells, and the skeletons of marine organisms to form sand. Eventually Hawaiian volcanoes become flat **atolls** surrounded by coral **reefs**.

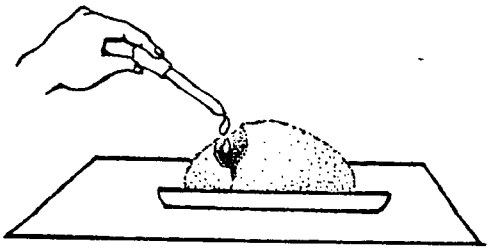
Teaching Suggestions

1. Distribute plates, sand, and hand lenses to students. Ask them to observe the sand grains closely. What shape are most of the grains? What causes them to be round? (wave action)

2. Have students examine small lava pebbles with a hand lens and describe what might have caused the pebbles to become rounded. (Stream and/or wave action) Discuss the process of erosion.

3. Ask students to describe other physical forces that might cause rocks to change (such as freezing and thawing). Discuss the process of weathering that causes rocks to break down.

4. Distribute chalk, vinegar and eyedroppers. Ask students to crush the chalk on their plates and add a few drops of vinegar. What happens? (Tiny bubbles of carbon dioxide gas will form as the vinegar, a weak acid, reacts with the limestone.) Students can put their ears close to the chalk and listen to the "fizz" of the chemical reaction. Explain that in a similar way, a weak acid continually breaks down or decomposes rocks, which are then eroded by streams.



5. Display the sand shield volcano prepared earlier and ask students to describe what happens to change the shape of shield volcanoes over time. Spray the sand volcano with water to simulate rain. Students will notice that there is little, if any change. Erosion takes place very slowly. To speed up the process, use an eyedropper or folded paper cup to pour water on the sand.

✔ 6. Ask students to build their own sand shield volcanoes on the plastic plates. Distribute newspaper and cups of water and challenge students to erode their volcanoes by slowly dropping water on the sand (using eyedroppers or folded paper cups) to create valleys resembling those on their own island.

7. Students may continue eroding the volcanoes until they are completely flat. Ask them what their island would be called if the flat surface were covered with coral and a lagoon (atoll).

✔ 8. Ask students to write an essay that begins with the statement, "I am a Hawaiian Valley." The essays should summarize how weathering and stream erosion changed the landscape over time and created the valley. Ask volunteers to read their stories aloud and see if their classmates can guess the identity of the valley.

Extended Activities

- Students could add a human element to their valley essays and relate the coming of the Polynesians and other people from the valley's point of view.
- Take the class outside to look for signs of weathering and erosion. Examine rock walls, cracked sidewalks or driveways and any exposed soil banks for evidence of weathering by plant roots. If there is a cemetery nearby, compare the weathering that has occurred on old stones to that of newer stones. Look for signs of rust on fire hydrants, fences, metal railings, bikes and cars.
- Shake a can of rocks for at least five minutes and then pour the contents onto newspaper. Examine any erosion that has occurred.
- Investigate how the freezing and thawing of ice causes weathering at high elevations on Mauna Loa and Mauna Kea. Have students fill plastic containers with water, cap them and put them in the freezer. The water will expand as it freezes and the containers may crack.
- Fill test tubes or baby food jars with sand and vinegar and watch bubbles form as the vinegar reacts with the limestone in the sand.