Island Formation

Summary

In this activity, students will discover what an island is and the ways in which islands are formed.

Objectives

At the conclusion of the lesson, students will be able to:

- explain what an island is, and distinguish islands from similar landforms
- compare and contrast the different ways in which islands are formed

Time

1 period

Background

Islands come in all shapes and sizes, yet most originated as volcanoes, even if no volcano is visible on the surface today. Most of these volcanic islands occur along the boundaries of tectonic plates, where the plates are colliding or moving apart. In fact, one can trace the boundaries of many ocean plates by locating "island arcs" such as Japan, the Philippines, and the Aleutian Islands. Less common are volcanic islands like those in the Hawaiian chain, which have occurred within a tectonic plate. These islands are produced by a stationary "hot spot" within the Earth's interior, from which hot magma rises, forming a series of volcanic islands as tectonic plates move slowly over the hot spot.

Not all islands originated as volcanoes. Some, called continental islands, are pieces of continental crust that broke off long ago from continents and drifted out to sea. Cuba and New Caledonia are examples of this island type. Some low islands also are formed on continental shelves by coral reefs and sediment building up slowly over time in shallow tropical waters. Similarly, coral reefs often ring tropical volcanic islands. Such volcanic islands may erode away or sink below the surface, leaving behind an atoll, a circular ring of coral surrounding a lagoon. If the ocean floor rises again, it may lift the atoll several dozen meters above sea level, creating a coral island.

The Bahamas and many islands in the South Pacific were originally just coral reefs. Other islands originate from a mixture of the standard island formation types. Whatever the formation type, an island's geologic history has an important influence on the island's natural resources, including its soil type and composition, minerals, and the availability of groundwater.

Teacher s Notes

Elementary: Perform this activity to reinforce students' understanding of the geology of islands and similar landforms. Some students may not realize that an island is the tip of a mountain stretching down to the ocean floor. This activity will help address this misconception.

Middle School and High School: This activity presupposes some familiarity with plate tectonics. Consult any Earth Science textbook for additional information on this process. Students will observe colored hot water (representing magma) rising upward from the plastic bottle (representing a hot spot) toward the bottom of the styrofoam "tectonic plate." As the styrofoam moves, the point of contact on the styrofoam changes, forming a new "volcanic island." Students should realize that they are modeling the formation of a chain of hot spot volcanoes, with a rigid "tectonic plate" moving over a stationary "heat source."

Vocabulary

Atoll, continent, hot spot, island, isthmus, landform, peninsula, seamount, tectonic plate

Materials

Elementary: modeling clay, newspaper, clear plastic rectangular shoebox-sized container (at least 5" deep), water soluble marker; **Middle School and High School:** same container as above, small thin-necked plastic bottle (approximately 3" tall), irregularly shaped piece of styrofoam, dark food coloring, hot and cold tap water, newspaper

Procedure

1. Introduce the lesson by asking students to define the term "island." Lead them through a discussion of similar landforms, such as peninsulas, isthmuses, and continents. Then, have students use available classroom resources, such as globes or atlases, to locate examples of each of these landforms around the world. Explain that not all mountains that rise from the ocean floor reach the ocean's surface. Those that do we call islands. Those that don't we refer to as seamounts. Further explain that some seamounts are still volcanically active and that occasionally a new island appears above the ocean's surface. This happened in the 1960s when the new island of Surtsey appeared off the coast of Iceland. Similarly, a new island is currently being created underwater off the east coast of Hawaii. Note that ocean waves, storms, and other forces are constantly eroding islands, and that once volcanic activity ceases, islands often slowly recede back into the ocean.

2. **Elementary:** Have students make a model of the ocean floor using clay to construct at least one island, seamount, continent, and peninsula within the plastic container. Instead of filling the container with water, have students mark "sea level" on the outside of the container using a water soluble marker. Then, have students examine their model from the side of the container (at and below "sea level") to gain an appreciation of what landforms look like from the ocean surface and from under the sea. After checking models to ensure accuracy, have students remove all the clay and clean the containers, which can also be used in the activity below. The clay can also be reused.
3. **Middle School and High School:** Explain the different ways that islands are formed. See the Background and Resources sections for more information. Have students make a model of how islands are formed by hot spots by following the procedure outlined below.
   a. Fill the plastic container about 2/3 full with cold water. (Note that the water must be at least 1" deeper than the height of the plastic bottle that will be inserted into it in Step 3c.) Place the container on a few sheets of newspaper to protect the table from splashes.
   b. Fill the plastic bottle about 3/4 full with hot water, then add 2 drops of food coloring to it.
   c. With your thumb over the opening, place the plastic bottle in the center of the container and then place the center of the styrofoam "tectonic plate" immediately above the bottle. Remove your thumb and observe the movement of the hot and cold water. (If an air bubble forms in the top of the bottle, use a pencil to dislodge it.)
   d. Gently nudge the styrofoam so that it slowly drifts to one side. Note how the point of contact changes between the styrofoam and the hot colored water.
   e. Write down a summary of your observations and how you think this activity relates to volcanic hot spots and island formation. What do the bottle, hot water, and styrofoam represent in this activity? What can you tell about the direction and speed of plate movement? What do you think are the strengths and weaknesses of this model?

Extend the Experience

Have students research one of the many active island volcanoes that exist today (e.g., Montserrat, Hawaii, etc.), determining how the volcano changes the island's geologic landscape, along with its plant and animal life. Have students create a poster and/or oral presentation on their findings.