

Ages and Stages: The Life of a Hawaiian Volcano

Next Generation Science Standards:

4-ESS1-1 Identify evidence from patterns in rock formation and fossils in rock layers to support an explanation for changes in a landscape over time.

4-ESS2-1 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

4-ESS2-2 Analyze and interpret data from maps to describe patterns of Earth's features.

Hawai'i Content and Performance Standards III:

SC.4.8.2 Describe how fast processes (e.g., volcanoes, earthquakes) sometimes shape and reshape the surface of the Earth.

SC.5.2.1 Use models and/or simulations to represent and investigate features of objects, events, and processes in the real world.

Description:

Students will learn about the evolution of a volcanic island from origin to erosion.

They will understand that Hawaiian volcanoes have gradually progressed through different stages as they are formed, emerge, and erode back into the sea from which they came.

Duration: 30 minutes

Objectives: At the end of this lesson, the students will be able to:

- Describe the impacts of deposition, weathering, and erosion on landforms.

Background:

Hawaiian volcanic islands have been forming over a hot spot on the ocean floor for millions of years. There are eight stages in their development and eventual erosion. They are: (1) initial - deep submarine stage, (2) submarine - shield building stage, (3) sea level - shield building stage, (4) subaerial - shield building stage, (5) capping stage, (6) erosional stage - reef growth, (7) renewed volcanism stage, and (8) atoll stage.

The relative age of an island or atoll can be determined based on its state of growth or erosion. The Hawaiian archipelago rides on the Pacific Plate that is moving in a northwesterly direction. The oldest islands in the archipelago are located far to the northwest of the main Hawaiian Islands. The youngest island (Lō'ihi) is forming under the ocean off the eastern coast of the Big Island of Hawai'i.

The island of Hawai'i is approaching mid-life, while Lō'ihi (still submerged) is still in the deep submarine stage. By contrast, Kure and Midway atolls are in the final stages of the life cycle of an island. The formation of fringing reefs combined with gradual sinking and erosion of an island causes it to eventually disappear from the surface of the ocean. During this process, reefs

grow vertically (upward) and begin to surround the island, eventually becoming separated from the island by a lagoon. If sinking continues, the island disappears and only a circular reef remains --- an atoll.

These websites provide background information about the each of the islands and atolls of the Northwestern Hawaiian Islands.

- Citizens Guide to the Northwest Hawaiian Islands Marine National Monument
http://www.papahanaumokuakea.gov/pdf/Citizens_Guide_Web.pdf
- Northwest Hawaiian Islands Marine National Monument virtual tour with photographs of islands in the Hawaiian archipelago at various stages of aging.
<http://www.papahanaumokuakea.gov/visit/welcome.html>
- Life of an Island: from Mountain to Atoll
<http://www.bishopmuseum.org/research/nwhi/geoact.html>

Vocabulary:

Archipelago: Chain of islands.

Atoll: Circular reef remaining after a volcanic island has completely eroded beneath the sea.

Subaerial stage: The above ground stage in the formation of a volcano.

Submarine stage: The underwater stage in the formation of a volcano.

Materials Needed:

Evolution of a Hawaiian Island Worksheet (included)

Evolution of a Hawaiian Island Answer Key (included)

http://www.papahanaumokuakea.gov/education/pdf/pnmn_map_poster.pdf

Procedure:

Step 1: Introduction

Right here on Maui we can see the aging of a volcanic island. West Maui is showing the signs of its age. It is nearly 750,000 years older than East Maui.

Instead of wrinkles, it has _____ to tell its age? = Valleys.

It's fun to learn about how the Hawaiian Islands have formed and are changing as they age. Let's learn about the life of a Hawaiian volcano!

Step 2: Review of Plate Tectonics and Hot Spot Theory

Review the concept of plate tectonics and hot spot theory to explain how volcanoes are formed over a single spot in the ocean floor, become islands, and drift toward the northwest. This map shows all islands and atolls in the archipelago:

http://www.papahanaumokuakea.gov/education/pdf/pnmn_map_poster.pdf

Step 3: Introduce the Eight Stages of a Hawaiian Island

1. Initial-deep submarine stage = earliest formation of building from the ocean floor

2. Submarine-shield building stage = growing larger nearing surface but still underwater
3. Sea level-shield building stage = emerging at the surface of the water
4. Subaerial-shield building stage = above water growth period, the mountain is growing
5. Capping stage = activity stops temporarily
6. Erosional stage-reef growth = weathering and erosion happen and reefs begin to form
7. Renewed volcanism stage = cinder cones and ash cones form from smaller eruptions
8. Atoll stage = weathering and erosion have reduced volcano back to near sea level

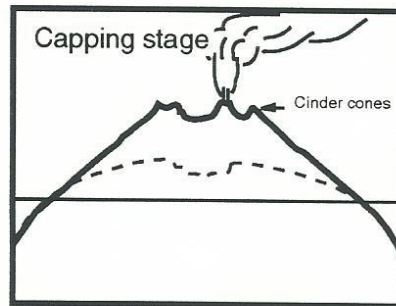
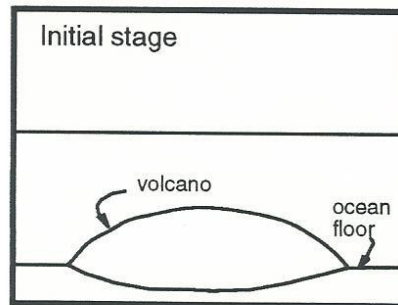
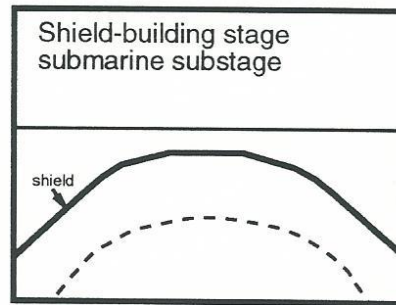
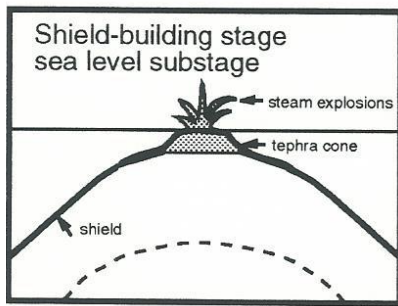
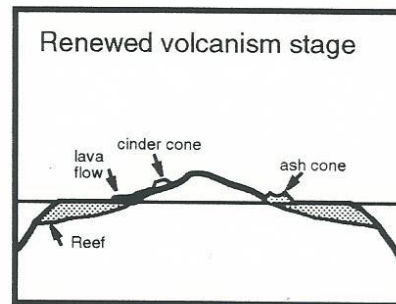
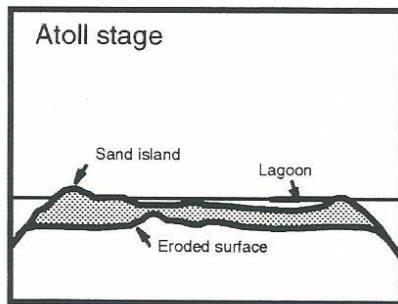
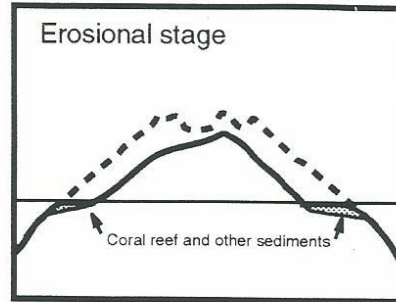
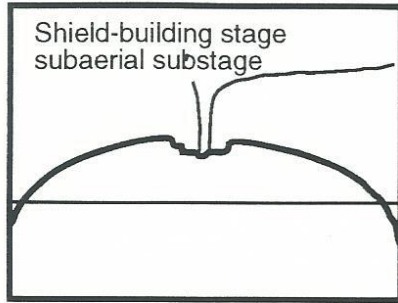
Step 4: Evolution of a Hawaiian Volcano Worksheet

Hand out the Evolution of a Hawaiian Volcano Worksheet and ask students to number the images of the volcano from 1 to 8 in the order they occur.

Reference: Mattox, S. (1994). *A teacher's guide to the geology of Hawaii Volcanoes National Park*. (Activity 4.2). Honolulu, HI: Hawai'i Natural History Association.

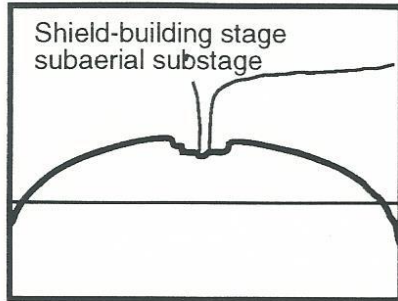
Evolution of a Hawaiian Volcano

Number each stage from 1 (first) to 8 (last) in the order they occur

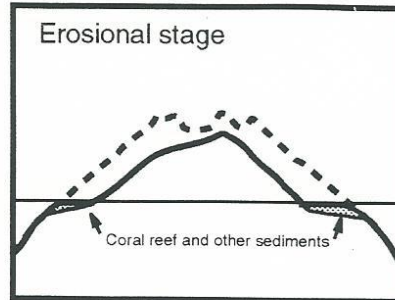


Evolution of a Hawaiian Volcano Teacher Answer Key

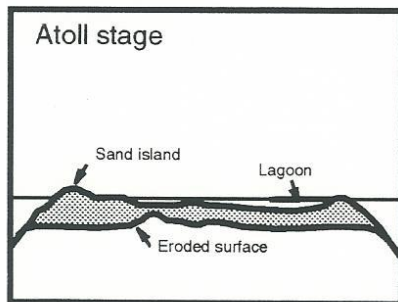
Number each stage from 1 (first) to 8 (last) in the order they occur:



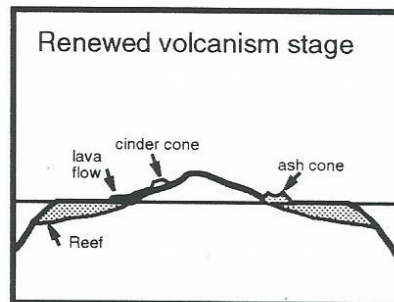
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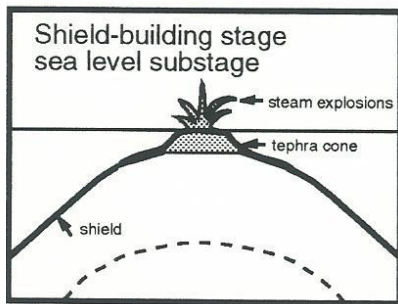
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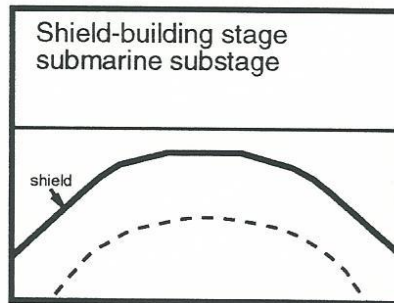
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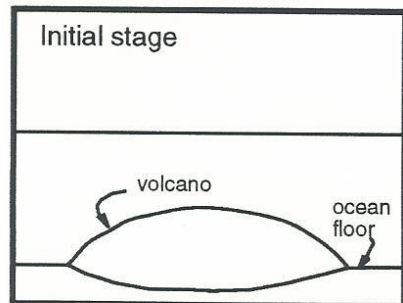
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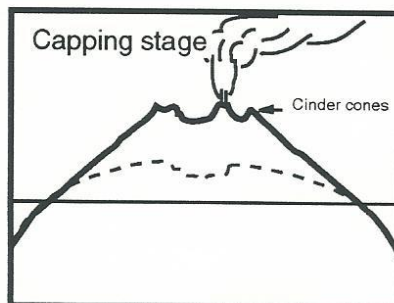
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2.



1.



5.