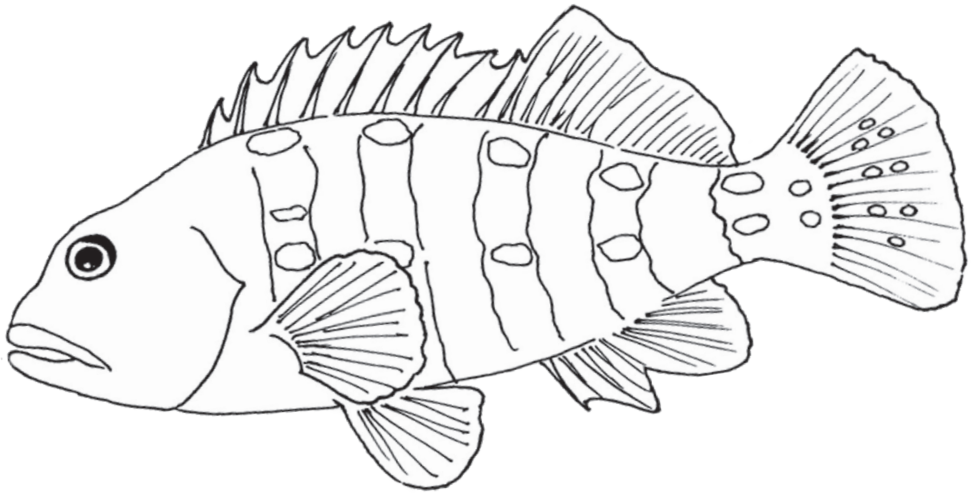

Hanauma Bay Education Program

Grade 8
Rock Cycle and Plate Tectonics

Tool Kit

UNIHI-SEAGRANT-EE-08-01

Geology of the Hawaiian Islands

Formation of the Island of O'ahu

Characteristic	Wai'anae Range	Ko'olau Range	Hanauma Bay
Type of volcano formation	Shield and post-shield (not andesitic which are explosive continental eruptions, lower temperatures, high SiO_2)	Shield (gentle eruptions) and rejuvenation (basaltic eruptions = low SiO_2 & high temperatures)	Rejuvenation Stage (basaltic, explosive hydromagmatic eruptions -- under water vents blasting through rock and reefs to form tuff)
Age	4 million years ago	1.8 - 2.5 million years ago	40,000 years (Koko Crater) 30,000 years ago (Hanauma)
Comparative Geologic Age	Oldest range	Younger range	Youngest crater in Honolulu Series (1 million years ago)…also includes Punchbowl and Diamond Head (hydromagmatic eruption)
When extinct?	2.8 million years ago	1.8 million years ago before rejuvenation stage 60,000 to 30,000 years ago	Still possible??
Caldera / summit region	Lualualei Valley	Pali = remnants of crater wall after major landslide into the water	
Area of O'ahu	1 / 3 of O'ahu	2 /3 of O'ahu	

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Plate Tectonics

STATE:

The formation of the Hawaiian Archipelago supports the Plate Tectonics Theory.

ELABORATE:

In other words…

Scientists believe that our land masses (continents and islands) sit on huge plates of earth's crust. These plates are in constant, though very slow, motion on the surface of the earth and are continuously being formed and consumed. Most of the creation and consumption of the plates takes place at the edges, where plates can slide under, collide with, or pull farther apart from others. Molten mantle below the crustal plates is hot and less dense in certain areas, cooler and more dense in other areas. The temperature differences of the magma results in material rising (hot areas), moving sideways, and eventually sinking (cooler areas)back to the interior of the earth. This movement of magma forms huge convection currents in the mantle layer, which in turn moves the plates sitting on top of the mantle. Depending on the plate, the direction of the movement is determined by the location of the magma rising to the surface, moving sideways, and sinking deep into a trench (moving under another plate). Islands in a linear chain form as the plate passes over a stationary hot spot, with an island forming on the plate from a limited eruption; the plate moves on and the next island forms with a subsequent eruption, and so on...forming younger islands as the plate continues to move.

EXEMPLIFY: *For example…*

The Hawaiian Islands sit on the Pacific Plate, which is moving from the southeastern edge of the Pacific Basin (off the shore of South America) in a northwesterly direction (toward Japan). The Hawaiian Archipelago, extending from the Northwest Hawaiian Islands (e.g. Kure Atoll, Midway, Necker, Nihoa) through the main islands (e.g. Kauai – Oahu – Maui - Big Island) is sitting on the Pacific Plate and therefore moving in the same northwesterly direction as the plate. Data on age of the islands that support the plate tectonics theory: Kauai is the oldest of the main islands - formed earliest, Oahu the next oldest – formed later, then Maui and finally the Big Island is the youngest island - still "growing". In addition to the age of the islands the arrangement of the archipelago in a relatively straight line suggests that the islands were formed when the plate slowly moved in a northwesterly direction over a stationary hot spot where magma was oozing from the deep mantle layer, forming the islands one at a time.

ILLUSTRATE:

The Hawaiian Islands forming one at a time as the Pacific Plate moves over the hot spot is like soft candy being squeezed (intermittent squirts) from an overhead tube, dropping to a conveyor belt, which slowly moves the separate pieces in a particular direction.

Map of the Hawaiian Archipelago showing the linear arrangement of the islands, from oldest (Kure Atoll) to youngest (Big Island).

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Hot Spot Theory

STATE:

The ***hot spot theory*** is supported by data from the formation of the Hawaiian Islands.

ELABORATE:

In other words…

EXEMPLIFY: *For example…*

ILLUSTRATE:

STATE:

ELABORATE: *In other words…*

EXEMPLIFY: *For example…*

ILLUSTRATE: