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SUBMARINE VOLCANOES AND THEIR CREATION
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ABSTRACT

This paper is about submarine volcanoes and their development either into atolls or volcanic islands. Information regarding the formation of each will be presented, along with the basic formation of the Hawaiian Islands and an explanation of how life forms came to populate the islands.

INTRODUCTION

When people first hear the word volcano, one of the first ideas that usually comes to mind is that volcanoes are destructive. However, this idea is not totally valid. The purpose of this paper is to show how creative underwater volcanoes can be in the formation of volcanic islands -- in particular, the Hawaiian Islands.

From information gathered through library research, we wrote about submarine volcanoes and what they create, the basic formation of atolls and volcanic islands, the basic development of each of the Hawaiian Islands, and how life came to these islands.

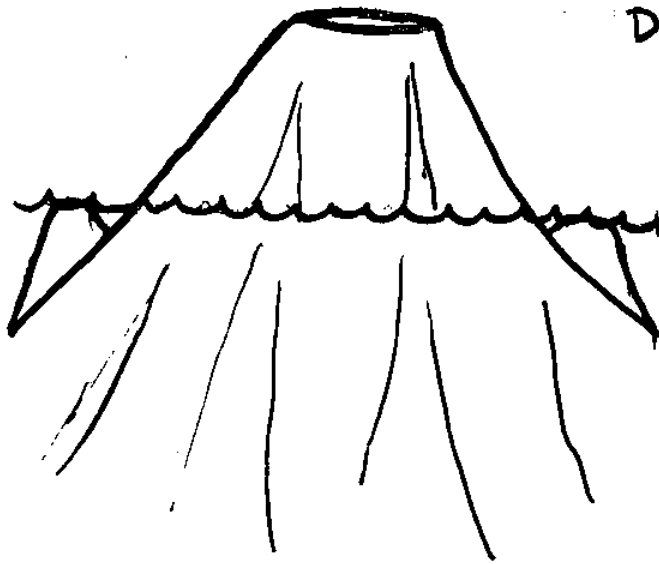
RESULTS OF RESEARCH

Islands are basically ephemeral -- created today, destroyed tomorrow. With a few exceptions, they are the results of the violent, explosive, earth-shaking eruptions of submarine volcanoes. These underwater volcanoes are responsible for the coral atolls of the South Pacific. Atolls are the last remaining tips of what were once islands. They are ring-shaped coral reefs surrounded by deep water. In the center of atolls are lagoons. They are found in areas where the sea floor was slowly sinking. Beneath every atoll is a volcanic island that has sunk. The island sank because of constant changes and shifts within the earth and because of erosion.

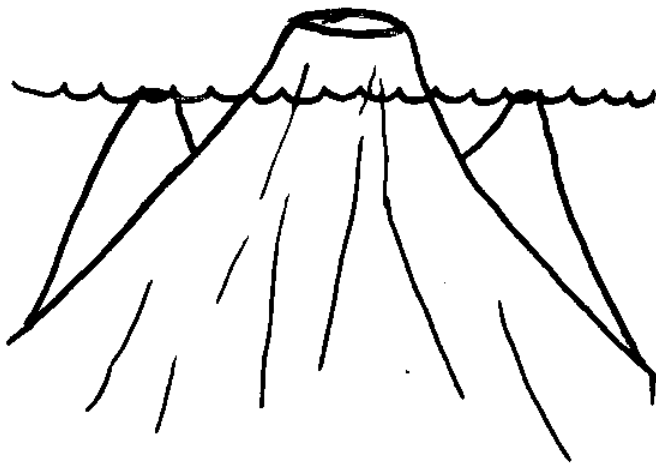
An atoll starts as a fringing reef, which is a coral reef growing on the sides of a volcanic island. As the island slowly sinks because of erosion, the coral reef continues to develop toward the surface. As more and more of the island is submerged, the faster the fringing reef grows. When the reef becomes separated from the island by a lagoon, it becomes a barrier reef. After thousands of years of gradual sinking, the volcanic island may disappear beneath the waves of the ocean. However, the coral reef has grown to the surface and is now called an atoll. As storms and waves wash over the coral reef, small islets are formed. After many years, coconut palms, mangroves and other plants may grow on the atoll.

Not all islands become atolls. Some remain as volcanic islands, as in the case of the Hawaiian Islands. The birth of a volcanic island is an event marked by a prolonged and violent struggle between two conflicting powers of nature. The forces of the earth are striving to create, while all the forces of the sea are opposing them. The sea floor, where an island begins, is probably nowhere

Development
of atolls



Coral fringing
reef starts.



Reef continues
to grow while
island sinks.
It is now a
barrier reef.



Island has
sunk. Reef
becomes a
ring-like
island, or an
atoll.



more than about fifty miles thick. In the sea floor are numerous deep cracks and fissures. The cracks and fissures are the results of unequal cooling and shrinking over the years.

Along such lines of weakness, the molten lava from the earth's interior presses up and finally escapes, bursting forth into the sea. The eruptions of submarine volcanoes differ from terrestrial eruptions in which lava, molten rocks, gases, and other ejecta are hurled into the air through an open crater. On the bottom of the ocean, all the weight of the ocean water presses upon the volcano. Despite all of this immense pressure, the new volcanic cone continues to build upward toward the surface with each new flow of lava. Extrusives on the ocean floor form pillow lava, which is soft ash rather than lava rock. Once the cone reaches the surface, the soft ash and tuff are attacked by the wind and waves. For a long period of time, the potential island is unable to emerge. Eventually, new eruptions occur and the cone is then pushed up into the air. The lava hardens and it is now able to withstand the attack of the waves.

Navigators' charts are marked with numerous recently discovered submarine mountains. Many of these mountains are the submerged remnants of the volcanic islands of yesteryear. However, among these undersea mountains may also be the islands of tomorrow.

The Hawaiian Islands are the peaks of mountains formed by volcanic buildup from the bottom of the Pacific. A number of active volcanoes still continue to spread layers of lava on the slopes and valleys around them. There are eleven main volcanoes in the Hawaiian chain. Mauna Kea, Mauna Loa and Kilauea on the Big Island and Haleakala on Maui are the most widely known. Although the Hawaiian Islands are millions of years old, they are still "new" islands for they are still growing and changing as new volcanic eruptions occur.

All over the earth, plates (broken pieces of crust) drift slowly. Under the Pacific Ocean, the Pacific Plate moves a few centimeters a year toward the northwest. Deep in the earth's mantle beneath mid-Pacific Ocean are magma chambers. During the last hundred million years, the Pacific Plate moved over these chambers and volcanic islands were formed. Each island began with lava flowing out of a crack in the ocean floor. At times, the volcanoes lay dormant; then they became active and erupted again. Slowly the volcanoes built submarine mountains out of many layers of lava. The mountains grew out of the sea and became islands. One hypothesis suggests that as the Pacific Plate drifted, the first volcanic island moved away from the magma chamber. A new volcano

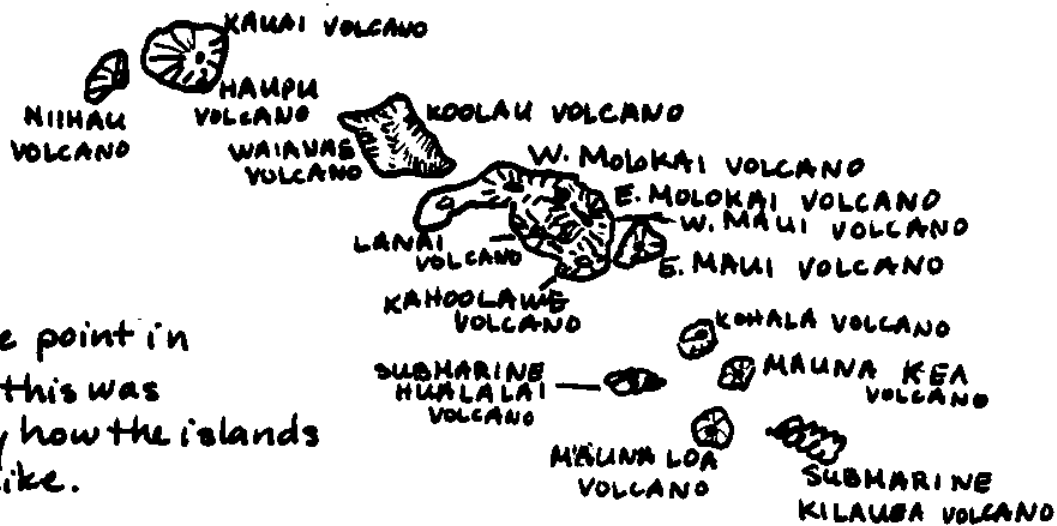
then formed to the southeast of the island. Gradually, a chain of many islands was formed. The last eight islands of this chain formed the state of Hawaii -- Niihau, Kauai, Oahu, Molokai, Lanai, Maui, Kahoolawe, and Hawaii.

Niihau was formed by a shield volcano, a dome-like volcano with gentle, sloping sides. Kauai was formed by two volcanoes, the Kauai volcano and the Haupu volcano. The calderas of these two volcanoes shaped most of the island. Oahu began as two separate submarine volcanoes which gradually became one island. The Waianae volcano is older than the Koolau volcano. These two volcanoes form the main mountain ranges of Oahu. Molokai started as two separate volcanoes, West Molokai volcano and East Molokai volcano. Gradually, they merged and became one. Lanai came from a shield volcano. Unlike the other islands, Lanai did not have any subsequent eruptions. Maui is composed of two volcanic mountains, East Maui or Haleakala volcano and West Maui volcano. Kahoolawe is made up of a single volcanic cone. In contrast to Kahoolawe, Hawaii, the Big Island, has been built by five volcanoes: Kohala volcano, Hualalai volcano, Mauna Kea, Kilauea, and the largest of all, Mauna Loa. All of the Hawaiian Islands were formed by shield volcanoes and went through periods of erosions, submergence, emergence, and subsequent eruptions (except for Lanai) until the islands had taken on their present shapes.

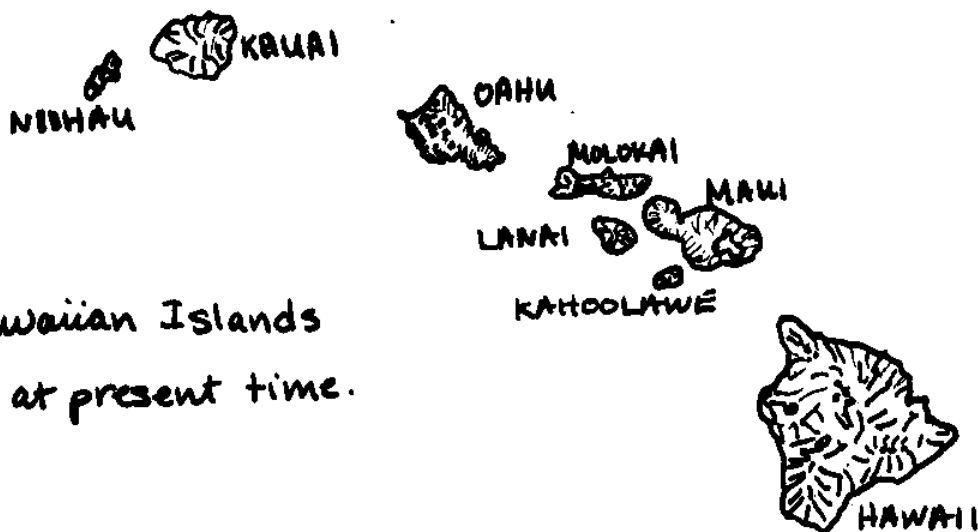
When the Hawaiian Islands were newly formed, they were not filled and covered with nature's beauty. In sharp contrast, when the islands were in their original states, the land was bare, harsh and repelling. The animal life of today's Hawaii did not move over the slopes of the volcanic hills. There were no green plants to cover the naked lava fields. Little by little, riding on winds, drifting on currents, or floating in on logs, bushes or trees, the plants and animals arrived from distant continents to colonize the bare land.

Scientists believe that a blue-green algae was the first plant to cling to the Hawaiian Islands. These algae and, later, the spores of lichen, mosses and ferns were carried by winds. When these pioneer plants were growing, dying and decaying, they mixed with the cinders, ashes and weathered bits of lava to form soil where other plants could grow. Carried by wind and water, new seeds found their way to these tiny islands. Over the countless years, about 275 kinds of flowering plants managed to arrive and live on the island chain. Because these plants were separated from the rest of the world, they developed, or evolved, into very special species of plants. Most of the native flowering plants and about two-thirds of the ferns are found only in Hawaii.

HAWAIIAN ISLANDS



At one point in history, this was basically how the islands looked like.



Hawaiian Islands at present time.

Water and wind brought floating and flying forms of insect life or the eggs of certain insects. One mammal, the hoary bat, may have been aided by the tradewinds on its journey to Hawaii. Another native mammal is the monk seal. Many birds were blown to the islands, bringing insects and seeds with them.

Later, man started to explore and seek new lands. Having found the Hawaiian Islands, he introduced new plants and animals. Thus gradually through the years, life came to populate and beautify the once barren, desolate islands.

DISCUSSION

Nature is constantly building up and breaking down its creations. This gradual and continuous process is shown in the formation of volcanic islands from submarine volcanoes. After years and years of gradual development, life comes to populate an island. Eventually, however, the island will break down unless there is lava to continue to build and form the island. This is true of the Hawaiian Islands. The Big Island is still growing as each new flow of lava continues to build up the island.

CONCLUSION

As a result of our library research on submarine volcanoes and the formation of islands, we are richer in knowledge of the geological history of the Hawaiian Islands. These islands are examples of creativity of volcanoes. Often volcanoes are associated with destruction because their eruptions can cause lava flows that destroy the life forms that lie in their paths, cover over spots of scenic beauty and change familiar contours of the land. The ejecta of the eruptions can cloud the atmosphere of surrounding areas. However, volcanoes, like other forces of nature, are part of the constant process of change: one side of the coin is destruction, but the other side is creation. We who live here in Hawaii can observe first-hand the destruction caused by volcanoes, but we can also appreciate the creation of volcanoes for our islands, like so many other islands, were formed by volcanoes that originated beneath the ocean waters.

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