Module 4: Bathymetry
Topic 4 Content: Seamounts and Guyots Notes

Imagine that you are mapping the floor of the Atlantic Ocean. You have crossed over the Mid- Atlantic Ridge and are making your way to Morocco, the final stop in your expedition. Getting over the peaks of the Mid-Atlantic Ridge was quite an undertaking! Now, you are hoping that you will find something more like the extremely flat abyssal plain on the other side. Things are relatively flat for some time, but then the ground begins to rise again. What are you climbing? Is this a continuation of the ridge, or something else?

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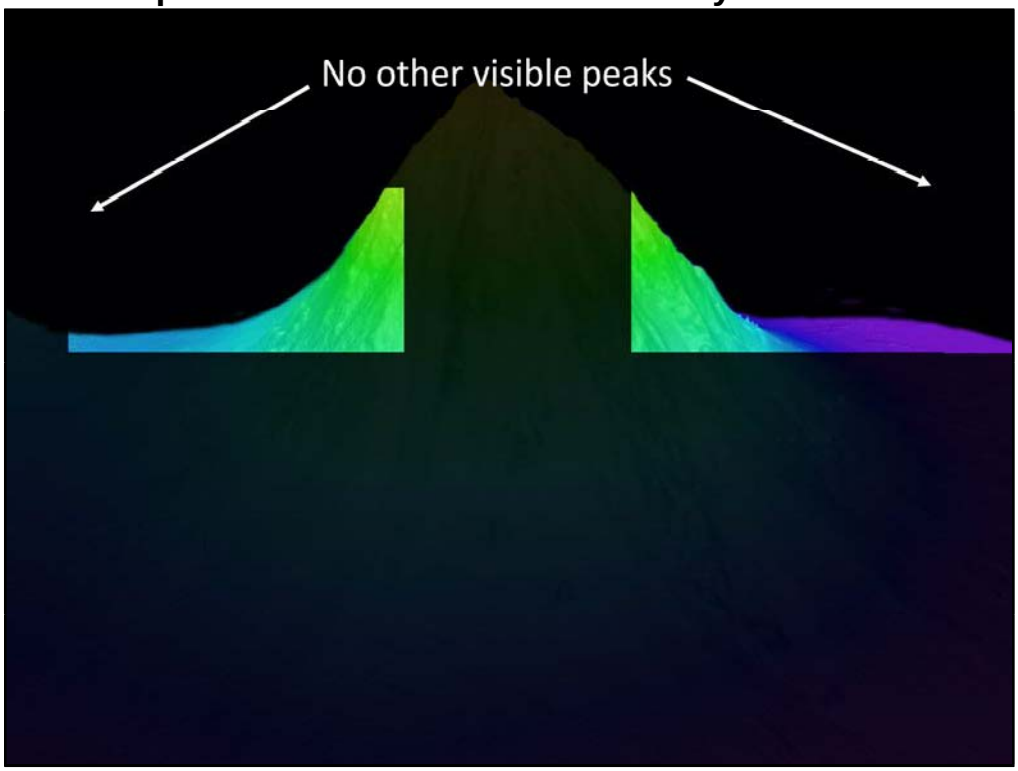

In order to determine what kind of hill you are climbing, you will need to take measurements and make observations to compare the hill with what you have already encountered. The quickest and easiest and easiest thing to measure is the slope of the hill. It certainly feels steeper than any abyssal hill you have encountered, and your measurements confirm it. This is too steep to be an abyssal hill.

With your powerful undersea lighting equipment, you illuminate the areas to the left and right of you. You do not see any other peaks which would indicate that this is part of a mid-ocean range, but there is no way to know to be sure without further investigation.

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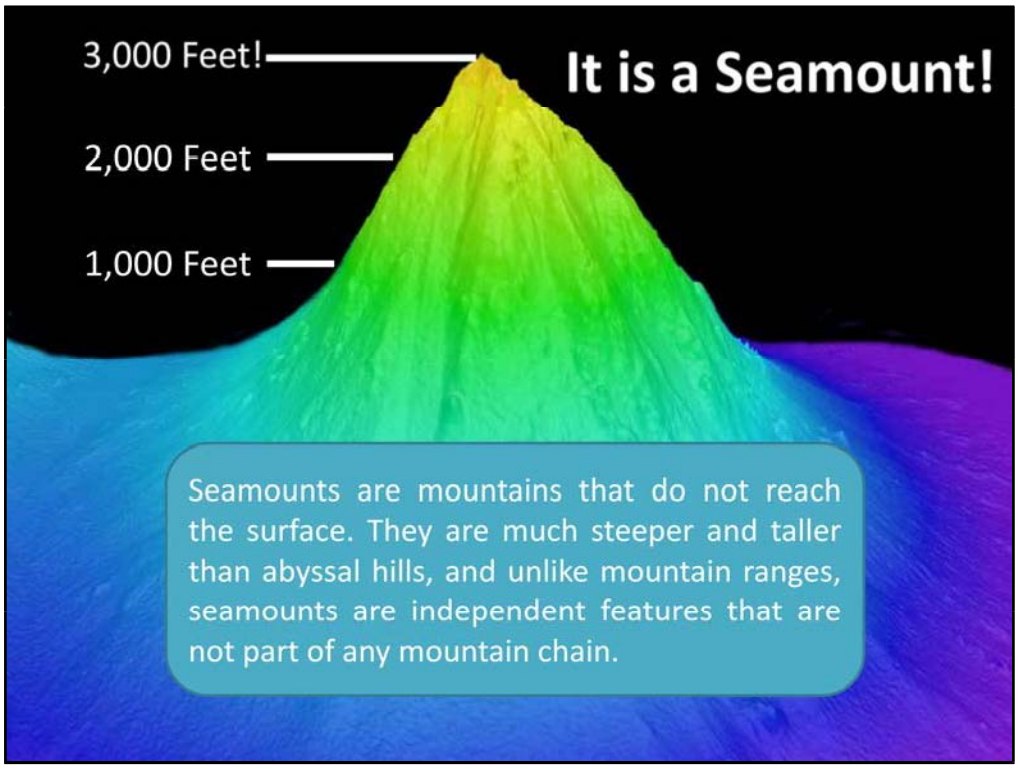

You decide to start climbing the hill, figuring that you will be able to see more as you rise from the ocean floor, or at least be able to measure its elevation. Up and up you go, past 1,000, then 2,000, and finally 3,000 feet. When you reach the top, which is rather pointed, you illuminate the surrounding area. Sure enough, this mountain stands by itself and is not part of any mountain range.

What you are standing on is a seamount. Seamounts are mountains that rise from the ocean floor, but do not reach the surface of the water. They are much steeper and taller than abyssal hills, and unlike mountain ranges, seamounts are independent features that are not part of any mountain chain.

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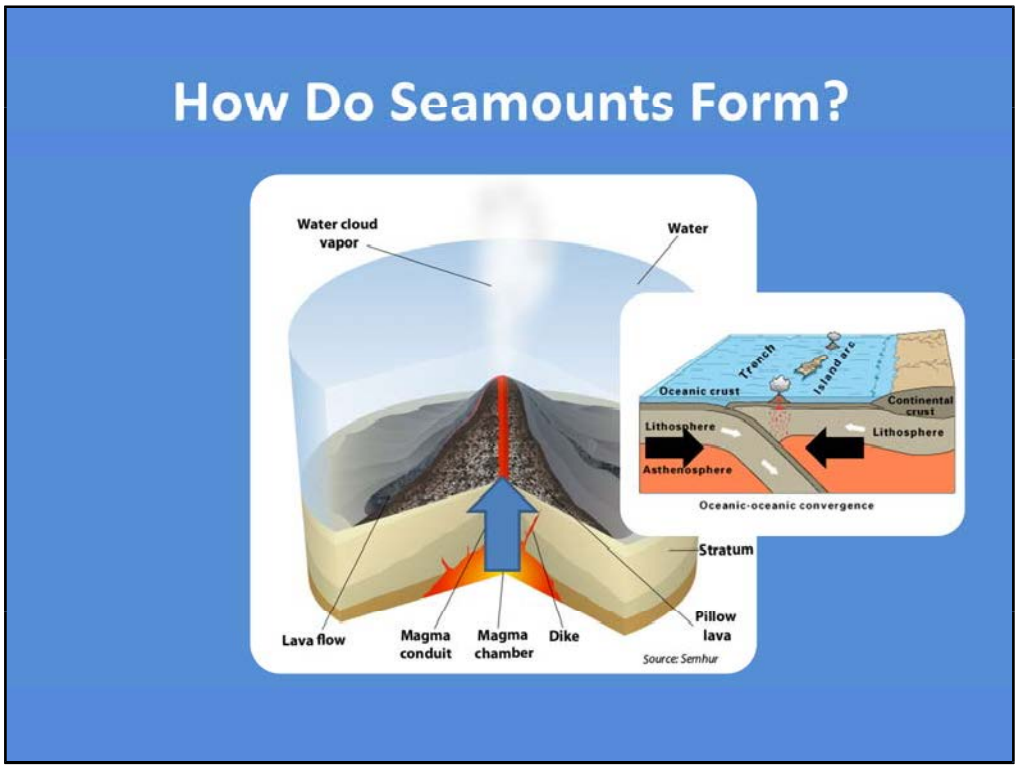

Like the mid-ocean ridges, seamounts are formed primarily by volcanic activity as magma pushes up through the Earth's crust in hot spots. Also, they can form when two plates collide at convergent plate boundaries where two tectonic plates push together. In rare cases, seamounts form near divergent boundaries.

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Under the right conditions, a seamount can continue to form until it rises above the surface of the ocean. Once this happens, it becomes an island. In some places, such as Hawaii, seamounts can form a chain of islands. The newest seamount to form in the Hawaiian Island chain is Loihi. It will be at least 10,000 years before this seamount rises above the ocean to form an island.

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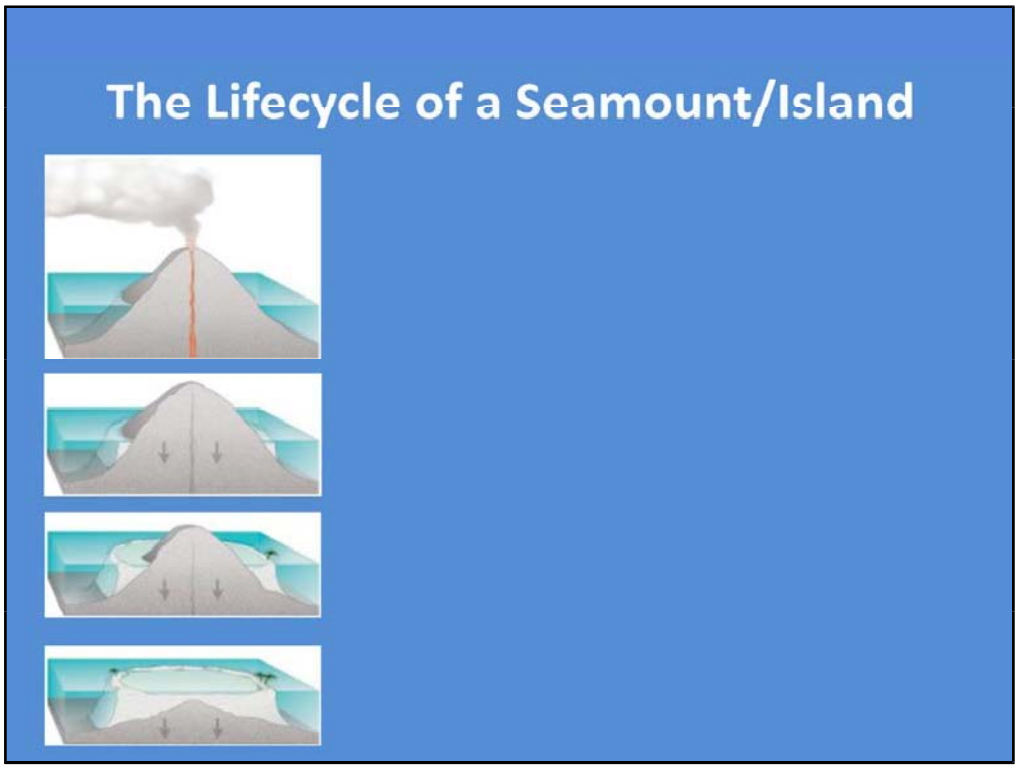

Eventually, all seamounts and islands stop growing as they move and get cut off from the source of their magma. When this happens, the erosion process takes over. In tropical and sub-tropical zones, after the volcano becomes extinct, coral reefs form around the island, growing on the sediment that has been deposited by erosion and other forces. The coral reef may result in a fringing reef which encloses lagoons between the coral reefs and the island.

As the island continues to erode over the next few thousand years, the fringing reef becomes a barrier reef as the lagoons become bigger and deeper. As the island erodes away, it appears as though the coral reef is moving away from the island. Eventually, the island erodes away entirely, and all that is left is the barrier reef surrounding an open lagoon. The barrier reef is now called an atoll.

The image shown here is an example of a fringing reef in The Maldives. Notice that the fringing reef has completely enclosed a lagoon around the island.

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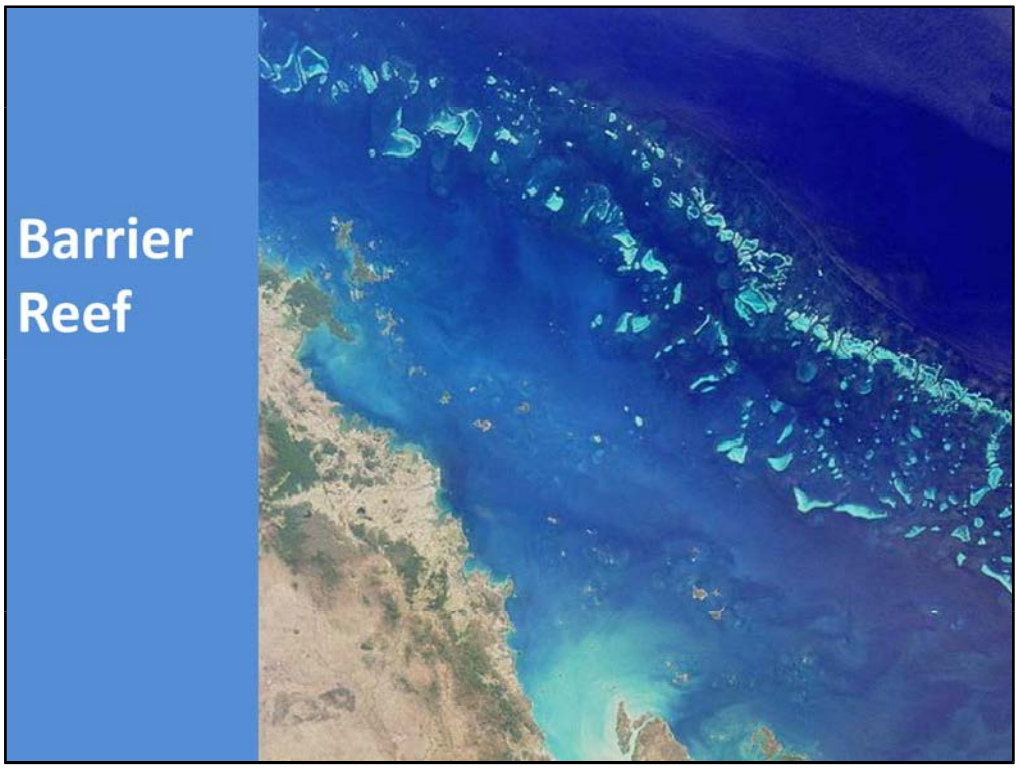

The image shown here is an example of a barrier reef off the coast of Australia. Notice that the distance between the land and the reef has grown over time and the lagoons surrounding it have become larger and deeper.

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The image shown here is an example of an atoll reef in the Federated States of Micronesia. Notice that the island has disappeared below the surface of the water and a central lagoon is completely surrounded by the reef.

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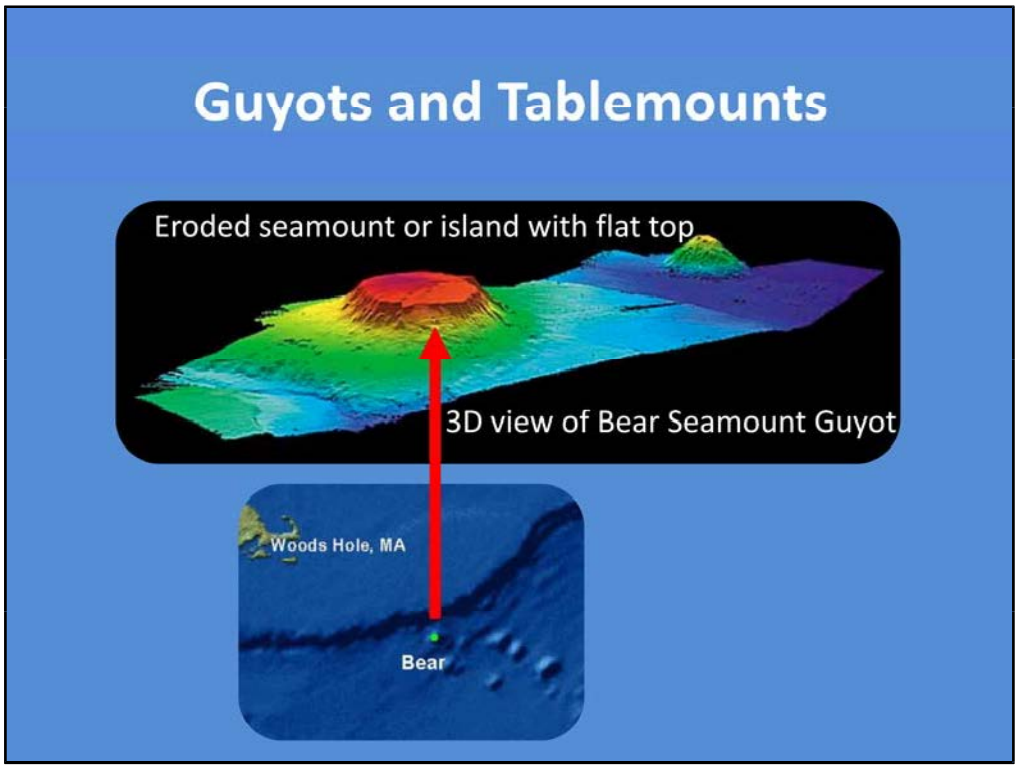

Erosion wears down seamounts in the same way. Over time, the top of the seamount tends to flatten out as the forces of the ocean wear the rock down. After a while, the seamount becomes a tablemount or guyot and continues to erode. The easiest way to tell the difference between a seamount and a guyot is that the seamount has a conical shape, while the guyot is flat on top. Geologist Harry Hess used the features created by seamounts and their erosion to help prove his theory of plate tectonics.

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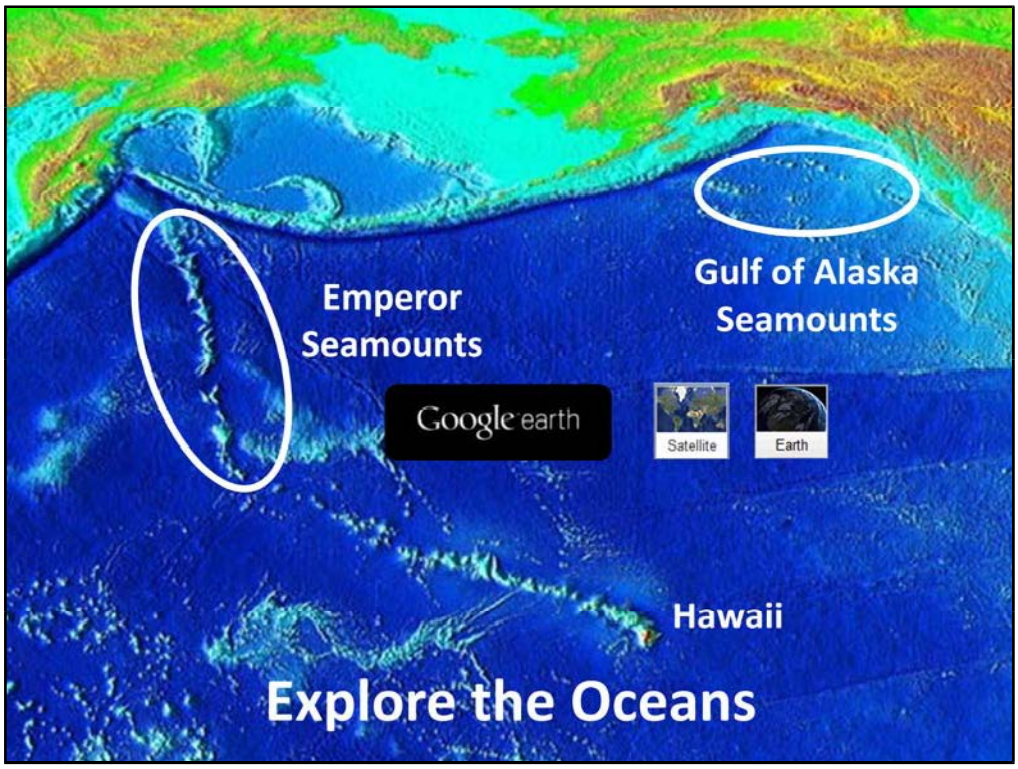

Although they are more common in the Pacific Ocean, you can find seamounts and guyots in all of the Earth's oceans. Some of the most famous seamounts are the chain of seamounts collectively known as the Emperor Seamounts and the Gulf of Alaska Seamounts, but there are many others.

One of the best ways to see where the seamounts and guyots are is by using the Google Earth™ mapping service. Click the link to open Google Maps™. Locate the Satellite link in the upper right corner of the map. Rest your cursor over the Satellite link, and select the Earth link when it appears next to it. You can then search for different seamounts or tablemounts, or simply explore the ocean floor.