How Do Seamounts Form?

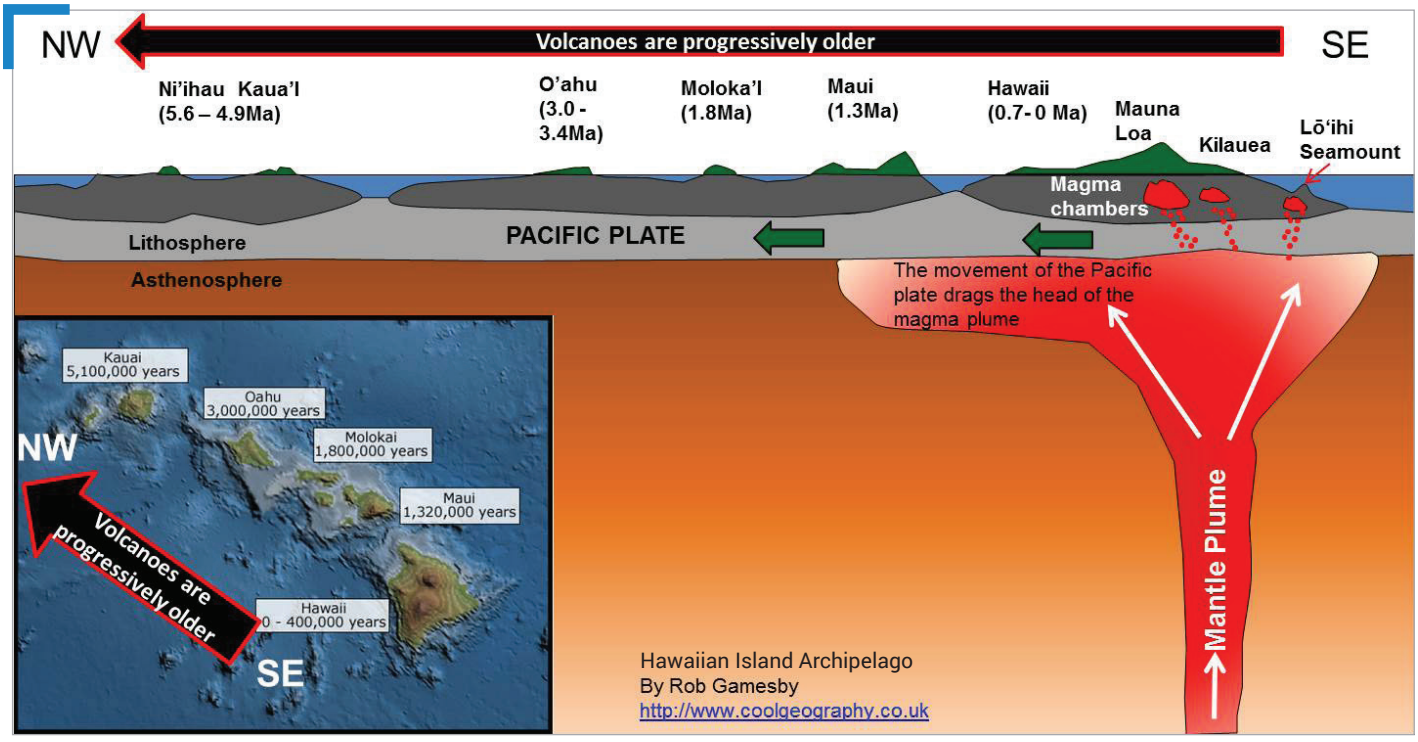
Seamounts are underwater volcanoes found in every ocean. They can form in different ways, but most are remnants of extinct volcanoes. Seamounts are generally found at mid-tectonic plate regions, called hotspots, and near the boundaries of tectonic plates.

Seamount Formation at Volcanic Hotspots

Volcanic hotspots are areas of Earth's mantle from which hot plumes rise upward, forming volcanoes on the overlying crust.

In much the same way that plumes rise in a lava lamp, plumes of mantle magma (molten rock) are thought to rise from a source within Earth's deep mantle. When such a plume rises into the shallow mantle, it partially melts. The melt may then rise to the surface, where it can erupt as a hotspot volcano.

Mantle plumes that form hotspots are thought to be relatively stationary, whereas the overlying crusts (tectonic plates) typically are not. As a plate moves over the location of a plume eruption, it carries successively older volcanoes with it. Eventually, the hotspot volcanoes become extinct. Over millions of years, these processes produce lines of islands and seamounts known as hotspot tracks or chains, also called archipelagos.



Volcanic hotspots form above plumes of hot mantle material rising deep from within the earth. These plumes are generally stationary – but due to tectonic movement, the plate above and any volcanoes formed by melting plume material will move away from the hotspot over time. Over millions of years, this process can produce chains of islands and seamounts. *Image courtesy of U.S. Geological Society.*

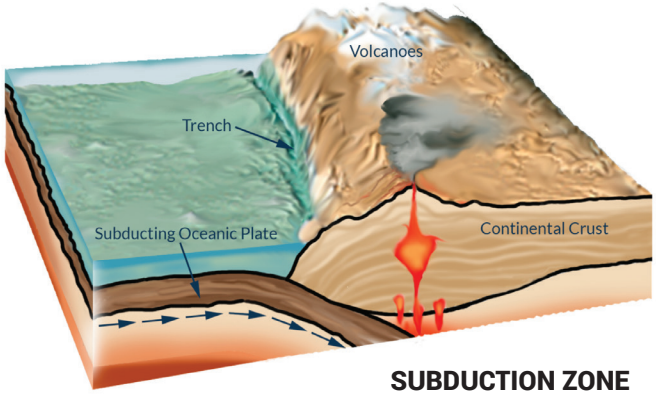
The Hawaiian and Samoan archipelagos in the Pacific Ocean are examples of seamount chains formed by hotspots. Both are linear chains of volcanic islands and seamounts atop the Pacific tectonic plate, which is moving slowly to the west-northwest (at about the same rate fingernails grow). The oldest islands and seamounts are located the furthest from the hotspot volcano. The islands and seamounts furthest to the east in both the Hawaiian and Samoan chains are the youngest.

- In the Samoan chain, Vailulu'u is the youngest hotspot volcano and is an actively forming seamount.
- Kama'ehuakanaloa (formerly named Lō'ihi) in the Hawaiian chain is also an actively forming seamount. It is located about 35 kilometers (22 miles) off the southeast coast of the island of Hawai'i.

How Do Seamounts Form?

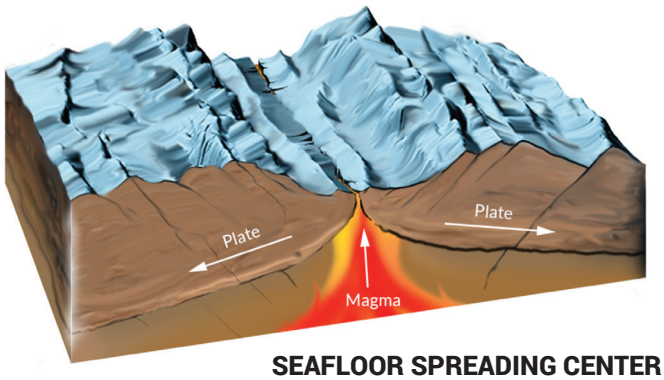
Seamount Formation at Plate Boundaries

Seamounts (and volcanoes) are also associated with **subduction zones (convergent plate boundaries)** and **seafloor spreading centers (divergent plate boundaries)**.



SUBDUCTION ZONE

Subduction zones are places where tectonic plates collide and one plate overrides another. Such a collision can involve two oceanic plates or an oceanic plate and a continental plate. When two oceanic plates collide, the overridden oceanic plate is consumed within Earth's mantle. During that process, magma rises from the downgoing plate, leading to an eruption that can form seamounts and islands.



SEAFLOOR SPREADING CENTER

Seafloor spreading centers, also called mid-ocean ridges, are linear volcanic ridges which extend through all the major ocean basins. Magma from Earth's mantle rises along spreading centers, erupts, and solidifies in an ongoing process that creates oceanic crustal plates. This volcanic activity can also create discrete submarine volcanoes which, through successive eruptions, can grow to become seamounts.

Geologic Forms - A Seamount by Another Name?

Seamounts may change form over millions of years and their shapes vary depending on volcanic activity and erosion. When a seamount rises above the surface due to volcanic activity, it is called a volcanic island. Waves, wind, and rainfall erode islands over time, and they may eventually sink below the surface again, sometimes forming atolls (ring-shaped coral reefs surrounding a lagoon) or guyots (flat-topped seamounts).

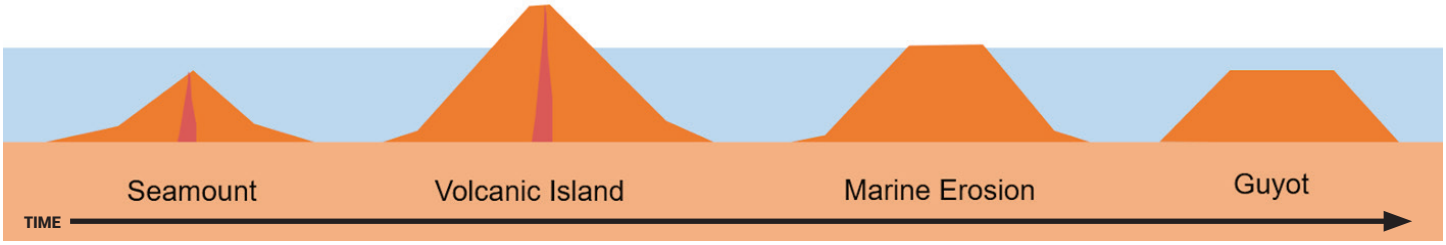
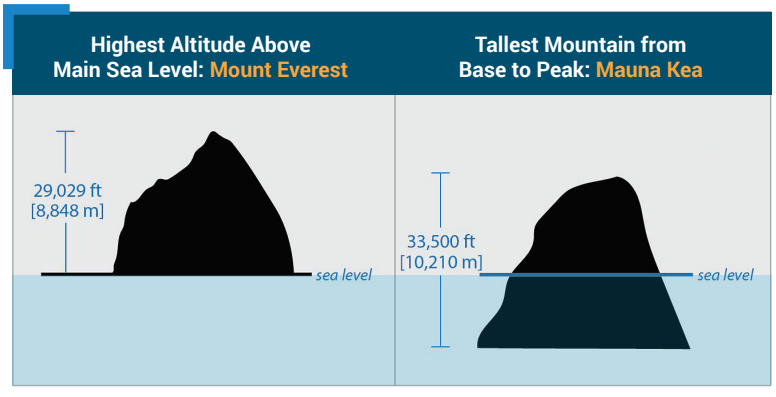


Illustration adapted from Alysha Johnson, Schmidt Ocean Institute.

Highest Mountain on Earth?

The Answer is Debatable.

The tallest mountain on Earth is also an island that started as a seamount — Hawai'i's Mauna Kea. It is more than 10,210 meters (33,500 feet) tall measured from its base on the seafloor. Its peak is 4,207 meters (13,803 feet) above sea level. In comparison, Mount Everest's summit is 8,848 meters (29,029 feet) above sea level.



Infographic adapted from NOAA Ocean Service.

Volcanic hotspots (webpage): https://oceanexplorer.noaa.gov/facts/volcanic-hotspot.html
Volcanic hotspot (image): https://www.coolgeography.co.uk/A-level/AQA/Year%2013/Plate%20Tectonics/Plate%20tectonics/Hotspots_formation.jpg
Vailulu'u, 2017 American Samoa Expedition (webpage): https://archive.oceanexplorer.noaa.gov/okeanos/explorations/ex1702/background/seamounts-life/welcome.html
Plate Movements (illustrations): https://divediscover.whoi.edu/plate-tectonics/plate-movements/
Mid-ocean ridges (image): https://divediscover.whoi.edu/plate-tectonics/plate-movements/
Seamount and Guyot (schematic): https://schmidtocean.org/cruise-log-post/what-are-seamounts-and-guyots/
Hawai'i's Mauna Kea (infographic): https://oceanservice.noaa.gov/facts/highestpoint.html

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