

Guyots and Atolls Encyclopedia Article

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Guyots and Atolls

A guyot is a flat-topped submarine mountain, or seamount, that once emerged above sea level as a volcanic island, and then resubmerged when volcanic activity ceased. **Erosion** by wave activity during submergence creates the characteristic flat-topped profile of a guyot. In some cases, carbonate reefs fringing an aging volcanic island continue to grow as the island sinks below sea level, leaving a circular island of coral, or an atoll, surrounding a round lagoon where the peak of the extinct **volcano** once stood. The British naturalist, Charles Darwin (1809–1882), observed atolls in the southwest Pacific Ocean during his nineteenth century travels aboard the *Beagle*, and he was the first to suggest that an atoll is a crown of coral on a newly-submerged guyot.

Seamounts are volcanic hills or plateaus formed by extrusion of **lava** onto the seafloor in places where plates of oceanic **lithosphere** override hot areas in the mantle near divergent plate tectonic boundaries called **mid-ocean ridges**, and over localized intraplate mantle upwellings called hot spots. Most seamounts never grow tall enough to become islands, but some very large ocean-floor volcanoes, particularly those above well-established **hotspots**, emerge above sea level before plate motion removes them from their magmatic sources. The Hawaiian Islands and Iceland are examples of oceanic islands created by vigorous hot spot volcanism.

After growth and emergence, large volcanic islands evolve through several stages of decline and submergence. The weight of a cooling volcanic construction depresses the lithosphere into an underlying plastic layer of the mantle called the **asthenosphere**. When volcanic activity ceases or slows, the rate of depression, or isostatic subsidence, outpaces the rate of volcanic construction, and the island sinks. Wave erosion cuts a bench encircling the declining island, and carbonate organisms, including corals, construct a ring of shallow-water carbonate rocks around it. As subsidence and erosion continue, the peak of the extinct volcano is planed off, and a carbonate lagoon fills the flat wave-cut surface creating an atoll. Eventually, the atoll sinks below the biologically productive photic zone, and carbonate production ceases. Most tropical guyots have a carbonate cap, while most high-latitude guyots do not. Once the guyot has fully cooled, it reaches a state of isostatic equilibrium and stops subsiding. Plate motion then carries the guyot passively toward a **subduction zone** where it will eventually accrete to a continental margin or subduct into the mantle.

See Also

Isostasy