

Island formation and tectonic processes

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Tectonic processes can form an island in one of two ways.

1. Those processes that cause a rise in water levels and flooding a pre-existing topography, known as tectonic flooding.
2. Those processes that cause uplift of the basin floor to form a topography that emerges above water level, called tectonic emergence.

The two may be combined or occur simultaneously at different locations.

Tectonic flooding occurs in the world's oceans by increases in the rate of sea-floor spreading, which, in turn, causes an increase in mid-oceanic ridge volume that raises sea level. Major continental collision will also change the volume of the ocean basins. Flooding due to either of these mechanisms will occur at geological time scales, but collisions will tend to be more rapid. In restricted lacustrine and marine basins, local tectonic emergence or basin deformation may cause local tectonic flooding and could be quite rapid on geological time scales.

Tectonic emergence is caused by several phenomena. These include uplift of convergent, fore-arc, accretionary complexes (Barbados); collisions, including continent-continent collision, arc-continent collision (Cuba, New Guinea) and arc-arc collision (Celebes), either head-on or oblique (New Guinea, Greater Antilles); or due to restraining bends on major strike-slip faults and at transform plate boundaries (New Zealand). The timing of emergence is very variable and maybe occur over millions to tens of millions of years. There will be an interplay between tectonic and climate-induced sea levels which is on the order hundreds of thousands of years.

Islands in extensional environments will only occur in restricted basins and tend to be ephemeral, as extension produces relief, but overall subsidence. Many emergent islands result from volcanic activities that are secondary results of tectonic processes: such volcanic islands result from subduction, leaky transform faults (Tristan da Cunha), passage of ridges over hot spots (Iceland) and hot spots themselves (Hawaii).