

### **Describe the characteristics, explain the formation, of deep sea trenches and island arcs**

Island arcs and trenches are major structural features, together with oceanic ridges, of ocean basins. The curvature and the volcanic nature are important characteristic features. The arc is convex toward the ocean and concave toward the continent with a deep trench running parallel to the arc along the convex (ocean) side. Arcs and trenches are hundreds of miles long.

Ocean trenches are long, narrow depressions on the seafloor. These chasms are the deepest parts of the ocean—and some of the deepest natural spots on Earth. Ocean trenches are found in every ocean basin on the planet, although the deepest ocean trenches ring the Pacific as part of the so-called “Ring of Fire” that also includes active volcanoes and earthquake zones. Ocean trenches are a result of tectonic activity, which describes the movement of the Earth’s lithosphere. In particular, ocean trenches are a feature of convergent plate boundaries, where two or more tectonic plates meet. At many convergent plate boundaries, dense oceanic plate slides beneath less-dense lithosphere in a process called subduction, creating a trench. When the leading edge of a dense tectonic plate meets the leading edge of a less-dense plate, the denser plate bends downward. This place where the denser plate subducts is called a subduction zone. Some ocean trenches are formed by subduction between a plate carrying continental crust and a plate carrying oceanic crust. Continental crust is always much more buoyant than oceanic crust, and oceanic crust will always subduct. Ocean trenches formed by this continental-oceanic boundary are asymmetrical. On a trench’s outer slope (the oceanic side), the slope is gentle as the plate gradually bends into the trench. On the inner slope (continental side), the trench walls are much more steep.

Some of the most familiar ocean trenches are the result of this type of convergent plate boundary. The Peru-Chile Trench off the west coast of South America is formed by the oceanic crust of the Nazca plate subducting beneath the continental crust of the South American plate.

An island arc is a curving series of volcanic islands which alignment is arc-shaped, and which are situated parallel and close to a boundary between two converging tectonic plates. Island arcs are formed where two lithospheric plates converge. Upon colliding, one of the plates—that bearing heavy, oceanic crust—buckles downward and is forced into the partially molten lower mantle beneath the second plate with lighter, continental crust. An island arc is built up from the surface of the overriding plate by the extrusion of basalts and andesites. The basalts are thought to be derived from the semi-molten mantle, while the andesites are probably generated by the partial melting of the descending plate and the sediments that have accumulated on its surface. These magmas then rise through fractures and melt their way through the overlying crust to be extruded in the form of volcanoes. The volcanoes are generally andesitic in composition. If the overriding plate is oceanic, then volcanoes are extruded underwater and may eventually rise high enough to become islands. The volcanoes form in a line because the angle and rate of subduction, and hence the distance to the depth where melting occurs is consistent.