

Converging Plate Boundaries

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Most convergent plate boundaries (where two plates move to each other in opposite directions) are called subduction zones, because one of the plates moves down, or is subducted, beneath the other. Often a deep trench forms on the ocean floor where the subducting plate begins its descent. Earthquakes are common in the subducting zone, particularly within the sinking lithospheric slabs, thereby producing an inclined zone of earthquakes that dips into the Earth's upper mantle typically at angles of 40°– 60° from the horizontal. Earthquakes can occur at any depth within the sinking slab, from shallow (0 - 60 km) to as great as 700 km. Over three-quarters of the world's earthquakes take place at convergent plate boundaries. As the subducted lithosphere moves deeper into the hot mantle, its fluids are "sweated out" and rise, triggering partial melting within the overlying mantle. The new magma is less dense than the surrounding mantle rocks (and the overlying lithosphere) and ascends buoyantly; some of it erupts on the Earth's surface to form a line of volcanoes. Such volcanoes typically are steep-sided cones called strato volcanoes that erupt explosively. Nearly four-fifths of the Earth's historically active volcanoes are found near convergent plate boundaries.

An excellent example of a convergent boundary is that between the Nazca Plate and the South American Plate. The overriding South American Plate has been deformed and thickened to form the Andes. The downgoing Nazca Plate forms the deep Peru-Chile trench and continues eastward beneath the South American continent. Magma, released by partial melting above the sinking Nazca Plate, rises to form many volcanoes along the Andes, the backbone of the South American continent. Where the plate descends at a very shallow angle, as evidenced by deep earthquakes occurring usually far from the trench in northern Peru and central Chile, partial melting is inhibited and no active volcanoes are present.

At other convergent plate boundaries, such as the Aleutian trench in Alaska, subducting results in a curved chain of submarine volcanoes or volcanic arcs (called an island arc) behind the oceanic

trench. Extensive island arc trench systems also exist in much of the western Pacific. Several of these subduction zones also show localized divergence that occurs behind the arc, known as back-arc spreading. The Marianas-Izu-Bonin arc is a good example of this configuration.

Convergence may also force two continents together, as is illustrated by the boundary between the Indian and Eurasian plates. Continental lithosphere is not as dense as oceanic lithosphere and resists subduction into the Earth's interior. The collision of India with Asia has doubled the thickness of continental crust in that region and produced the highest elevations on Earth in the Himalayas and the Tibetan Plateau. Continent to continent convergence produces shallow and intermediate depth earthquakes, but little volcanic activity.