Hot, molten magma from deep within the earth rises to the surface along a narrow fracture that runs the length of the East Pacific. The new lava pushes older material away from the spreading zone, forming the East Pacific Rise. Where cooler, dense ocean crust crashes against lighter continental material, the heavier oceanic crust is pushed beneath (subducted) the continents, forcing the ocean crust back into the furnace of the earth. Some of this material melts and bubbles back up to the surface, forming the chains of volcanoes that comprise the Andes and the Central American volcanic cordillera. This same process created the Sierra Nevadas and the Peninsular Mountain Range forming the west side of the Salton Basin between 150 to 90 million years ago—mountains made up of huge granite domes, the result of molten bubbles or "plutons" that hardened beneath the earth's crust.

About 30 million years ago, the North American continent, floating on the heavier magma beneath, overrode the East Pacific Rise, also known as the Farallon Plate, stopping subduction along California's west coast. The spreading energy between the Pacific Plate and East Pacific Rise was "transformed" along a lateral fracture of the now buried East Pacific Rise, creating the San Andreas Fault. The East Pacific Rise is still very active, running up through the Gulf of California, separating the Baja Peninsula from mainland Mexico. The most visible result of this volcanic activity in the Basin are the four volcanoes at the south end of the Sea: Rock Hill, Mullet Island, Obsidian Butte, and Red Island. Energy from rising magma is still evident in the geothermal hot springs: temperatures at 8,000 feet (2,400 meters) deep exceed 680° F (360° C), providing the source for geothermal power plants in the Imperial Valley. In a few places, bubbling mud volcanoes over 8 feet high (2.4 meters) and sulfurous sinkholes still punctuate the surface.

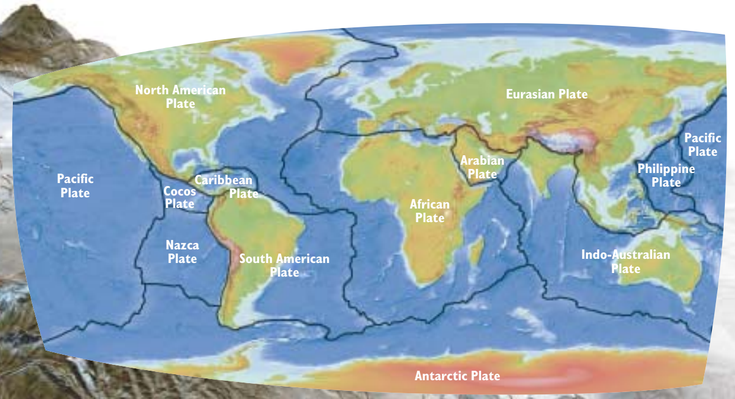
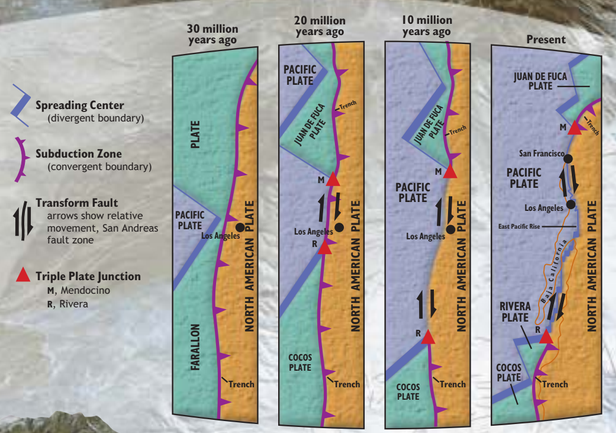


Plate Tectonics

Inspired by the "fit" of the Americas with Europe and Africa, the theory of plate tectonics was first postulated by Alfred Wegener in 1915, stating that the continents "drift" like rafts on denser oceanic crust. Lacking evidence of the causal mechanisms behind continental drift, however, the theory was debated and debunked at the time. Now, thanks to deep oceanographic mapping and high-resolution satellite imagery, scientists can not only explain the mechanics of plate tectonics, but can measure the relative movements of the continental plates in millimeters per year.

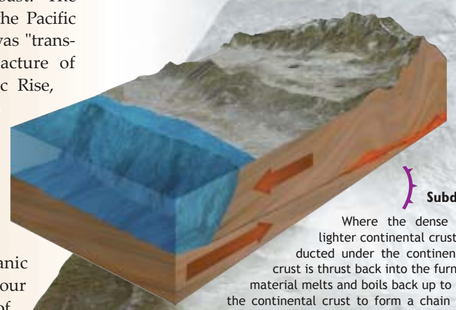
Geomorphic Provinces

Within North America, mountain ranges, plateaus, plains, and basins owe their formation to various geologic processes. These diverse regions are called "geomorphic provinces." For example, subduction of the East Pacific Rise under the North American Plate pushed up volcanic mountains to create the Pacific Mountain System. Similar means formed the much older Great Basin and Range, but rain, wind, and massive prehistoric water bodies further shaped this region over millions of years. Geomorphic settings greatly influence today's climate patterns, vegetation, and even human settlement.



Colliding Plates

The subduction of the Farallon Plate 30 million years ago caused mountains to uplift along the west coast of California. About 10 million years ago, the infant San Andreas Fault appeared, causing the Pacific Plate to start moving to the northwest and the Gulf of California to open and spread apart four million years ago. As the Gulf, and its landward extension, the Salton Basin, opened there was subsidence (sinking) of the gulf seafloor and the Basin floor.



Subduction

Where the dense oceanic crust collides with lighter continental crust, the oceanic material is subducted under the continental material. As the oceanic crust is thrust back into the furnace of the earth, some of the material melts and boils back up to the surface, breaking through the continental crust to form a chain of volcanoes, as exemplified by the Cascades in North America and the Andes in South America.

Transform Boundary

A transform boundary, or fault, is where two plates slide past each other. The build up and release of tension between these massive plates is one of the causes of earthquakes.

Spreading Center

Rising molten magma from deep within the earth reaches the surface and spreads out in either direction along the East Pacific Rise, creating new oceanic crust. Older material pushes steadily outward and away from the spreading center, becoming cooler and denser as it rides on this crustal conveyor belt.