HOT, molten magma from deep loops 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 Nevada 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 “plumes” 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, Obsidian Butte, and Red Island Energy. 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.

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Plate Tectonics

Inspired by the “fit” of the Americas with Europe and Africa, the theory of plate tectonics was first published by Alfred Wegener in 1915, stating that the continents “fit” like the pieces of puzzle ocean crust. Lacking evidence of the tectonic mechanisms behind continental drift, however, the theory was debated and doubted at the time. Now, thanks to deep seismographic mapping and high-resolution satellite imaging, scientists can explain the entire history of plate tectonics, but can measure the relative movements of the continental plates in millimeters per year.

Where the dense oceanic crust collides with lighter continental crust, the oceanic material subducts 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, exemplified by the Cascades in North America and the Andes in South America.

Subduction

Subduction is the process by which oceanic crust is thrust back into the earth’s mantle. As the oceanic crust is subducted, it becomes cooler and denser as it rides on this crustal center, becoming cooler and denser as it rides on this crustal center. As it moves away from the subduction zone, it is either destroyed or recycled in the earth’s mantle. The subduction of the Farallon Plate 30 million years ago caused mountains to rise along the west coast of California, about 10 million years ago, the San Andreas Fault appeared, causing the Pacific Plate to start moving. In the northwest and the Gulf of California it rose 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 seaside and the Basin floor.

Geomorphic Provinces

Geomorphic provinces letters north america, mountain range, plateau, plain, and basin owe their formation to various orographic processes. These diverse regions are called “geomorphic provinces.” For example, carbohydrates of the East Pacific Rise under the north american Plates pushed up volcanic mountains to create the Pacific’s Mountain System. Similar ranges formed the multi-water Great Basin and range, but rise, wind, and massive perennial water bodies further shaped this region over millions of years. Geomorphic settings greatly influence today’s climate patterns, vegetation, and even human settlements.

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