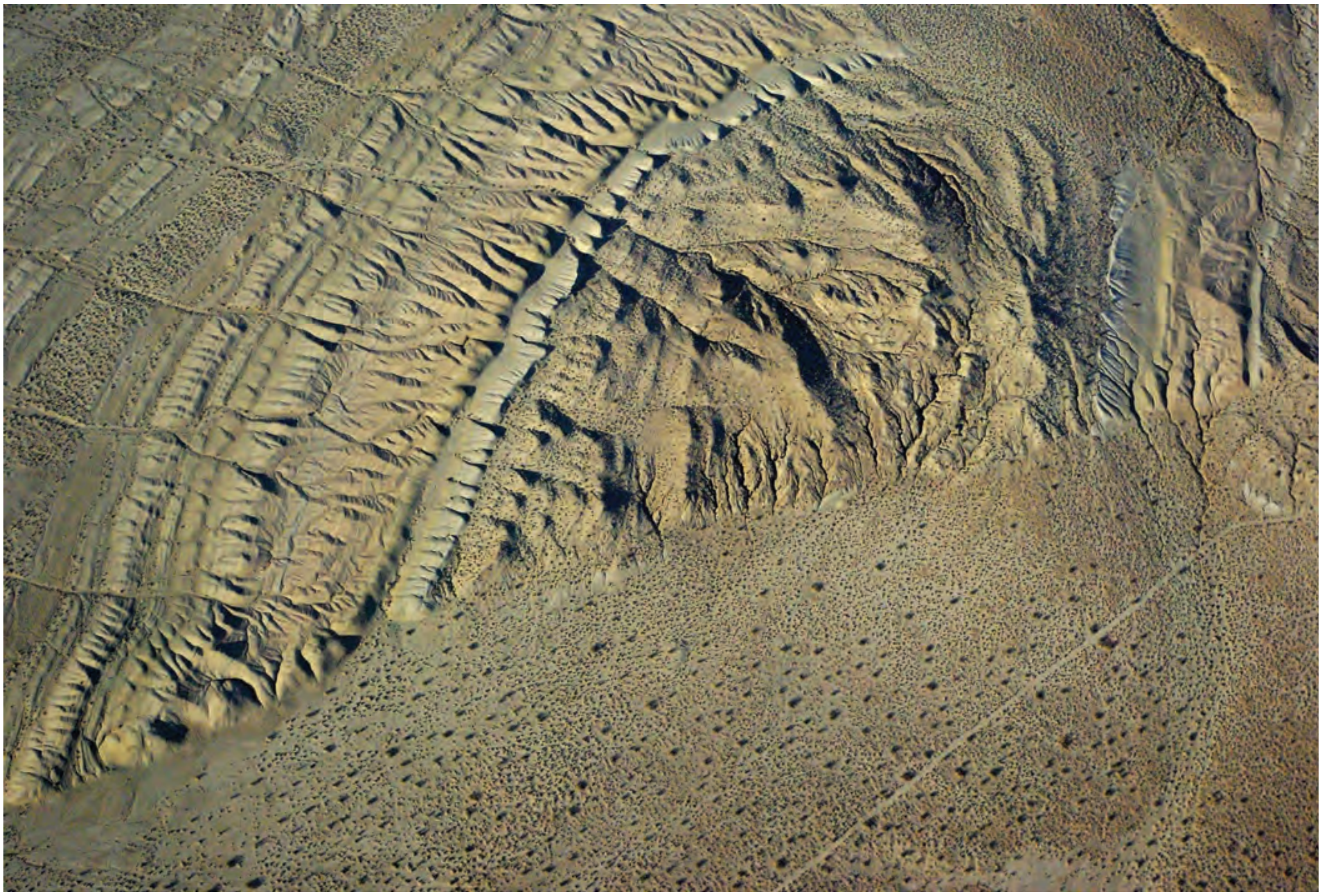
Anza-Borrego Desert State Park

National Natural Landmark 1974



Twisted and Broken

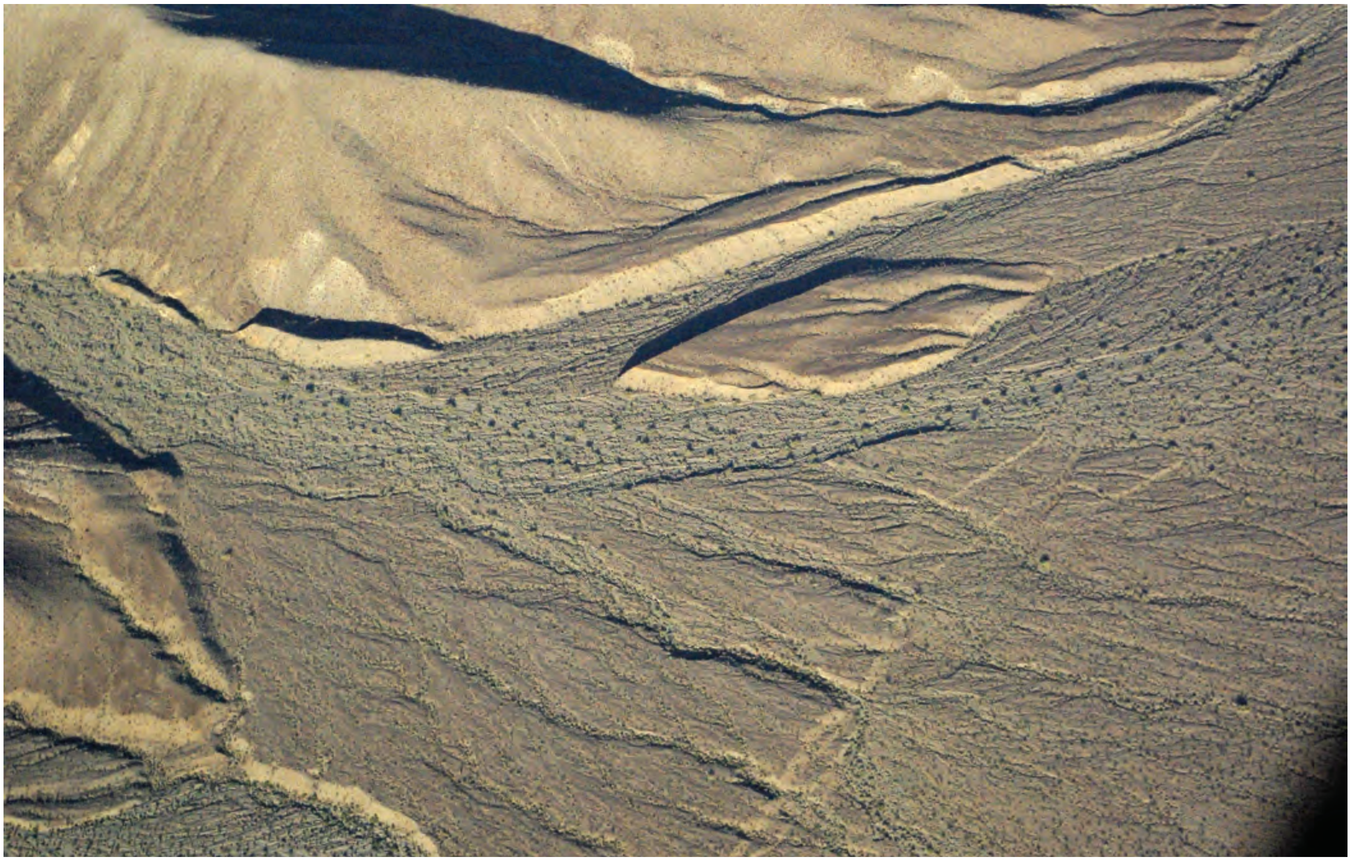
In addition to lying along the boundary between the North American and Pacific tectonic plates, Anza-Borrego Desert State Park occupies a large portion of the eastern Peninsular Ranges geomorphic province. It actually occurs in the boundary zone with the Colorado Desert Geomorphic Province. The two provinces interfinger with each other. The rocks from each province mutually overlap and mix as the boundary adjusts one way or the other. The mountains belong to the Peninsula Ranges Province, while the valleys belong to the other. The boundary is a collection of faults which are planes along which rocks on either side are shuffled. In the park, there has been much redistribution of rocks. Boundary adjustments are illustrated by progressive changes in activity along the various faults. This complexity is a side-effect of a more profound, much larger scale boundary between the two tectonic plates which grind past another at rate of ~35 mm/year.

Feature(s):

Earthquake deformation

Why it's important: Anza-Borrego Desert State Park is a great park to observe fault features and studying earthquake hazards, due to the relative lack of vegetation and development, its large size, and its location along the tectonic plate boundary. Both the Elsinore and San Jacinto Faults cut through the park. Historic accounts of earthquakes in this region are readily available but only date back several decades. One way to discern the longer history of earthquakes is to view how segments of faults have disrupted the topography. Scars from past earthquakes often form abrupt vertical steps (scarps) in the landscape. When fault scarps cut across youthful geomorphic features such as alluvial fans and dried lake (playa) deposits, we can deduce that the earthquakes that produced the scarps occurred sometime after deposition. Many of the alluvial fan surfaces and playa deposits are less than several thousand years old. In the park, there are several locales where fresh faults scarps can be seen.

Throughout most of California, the San Andreas Fault functions as the boundary (suture) between the North American plate and the Pacific plate; that is, rocks west of the fault actually are passengers of the northwesterly bound Pacific plate. The boundary splits into several roughly parallel fault zones south of the Transverse Ranges—the San Andreas proper, the San Jacinto, and the Elsinore Faults. The San Andreas proper lies to the east of the park and runs along the eastern shore of the Salton Sea. The Elsinore and San Jacinto Faults cut through the park and split into several strands. Consequently, the plate boundary becomes a 100-mile-wide boundary zone south of the Transverse Ranges with the Salton Sea as its centerpiece. The sea occupies a sunken area in a large rift zone known as the Salton Trough. The water level in the Salton Sea is currently 245 feet below sea level but 300 to 500 years ago it was 42 feet above sea level and inundated portions of the park.



What you can see: Fault scarps across fans and lakebeds, truncated or notched ridges.

San Jacinto Fault Zone

This fault zone is of considerable interest to earth scientists. The San Jacinto Fault zone is composed of discrete yet related branches known as the Coyote Creek, Buck Ridge, Clark, San Felipe, Superstition Hills, and Superstition Mountain Faults. Each branch is very active and capable of producing strong earthquakes. Recent local, moderate magnitude quakes occurred at Arroyo Salado (1954), Borrego Mountain (1968), and Superstition Hills (1987).

Evidence of recent faulting and change can be read in the faceted spurs along Coyote Mountain and east of Clark Valley on the west face of the Santa Rosa Mountains. Well-preserved fault-scarps, offset drainages, sags, shutter and pressure ridges, aligned valleys, and offset alluvial fans testify to the recent vertical and lateral land movement.

Elsinore Fault Zone

In Anza-Borrego, the Elsinore Fault zone is comprised of the following faults: Agua Tibia-Earthquake Valley, San Felipe, Tierra Blanca Mountains Frontal, and Vallecito Creek faults. Each of these is capable of generating a major earthquake. The impressive landscape along County Highway S-2 through the Carrizo Corridor is a result of the combined tectonic movements of these faults. South of the international border, the Elsinore Fault zone's continuation is the Laguna Salada Fault, which was responsible for the 1892 quake that caused considerable alarm in the San Diego area, cracking large buildings and causing landslides. That quake produced an impressive fault scarp through southern Anza-Borrego. Its 12-feet vertical fault scarp rivals well-known escarpments along the eastern Panamint Mountains in Death Valley, the Lone Pine fault escarpment in the Alabama Hills of Owens Valley, and the Hilton Creek fault scarp south of Mammoth Lakes in the eastern Sierra Nevada.

During the 1892 Laguna Salada quake, the western edge of the sediment-filled Vallecito-Fish Creek Basin dropped by as much as 20 feet.

The Tierra Blanca Mountains Frontal Fault is prominent between Agua Caliente County Park and Bow Willow. It separates the Fish Creek Mountain tilt-block from the Tierra Blanca Mountains. During the 1892 Laguna Salada quake, the western edge of the sediment-filled Vallecito-Fish Creek Basin dropped by as much as 20 feet.

Final Thoughts

Earthquakes are a part of nature's grand process that continually molds and shapes the fragile crust of Anza-Borrego. Although these complex fault processes may appear dormant, occasionally they lurch dramatically. Many of the iconic desert features such as hot springs, badlands, palm canyons, sand dunes, arroyos, and desert peaks are the result of ongoing geologic construction.

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