Ocotillo Wells SVRA

State Vehicular Recreation Area

Photo: Mike Fuller

Springs and Oases

Process/Feature:
Tectonics and desert hydrogeology along the plate boundary

Ocotillo Wells State Vehicular Recreation Area contains two spring-fed palm oases (Five Palm Spring and Seventeen Palms) that provide refuge from the oftentimes intense heat. The oases stand in stark contrast to barren badlands that surround them. In the arid desert, springs provide havens that were a necessity for early human inhabitants and explorers, and remain so for wildlife. In the geothermal area of the Salton Trough, the springs are quite different. These include gas-charged mud springs and hot springs.

The scarcity of water in the park is also in stark contrast with the recent past. As recently as 300 years ago, the eastern half of the park was submerged beneath ancient Lake Cahuilla —a predecessor of the Salton Sea. Fossil oyster shells at Shell Reef indicate that even before freshwater Lake Cahuilla, the basin was submerged beneath marine waters in an extension of what is today the Gulf of California.

Why it's important: Major geologic forces are play at the park which is caught in a tug-of-war along the boundary between the North American and Pacific plates. As the Peninsular Ranges of southern California and Baja move to the northwest with the Pacific plate, they pull apart and tear the plate boundary along the San Jacinto Fault and the Salton Trough. The Salton Trough is a major rift zone that includes the eastern portion of the park. Within the rift, the crust is stretching and becoming thin, allowing the earth's usually deep heat to rise toward the surface. Active strands of the San Jacinto Fault system cross the western portion of the park. In 1968, the park was shaken by a moderately strong earthquake (magnitude 6.6) and the ground along San Felipe Wash cracked along a strand of the fault.

Salton Trough

The Salton Trough extends from Palm Springs to the Gulf of California. Much of the trough is below sea level. At its deepest, the trough lies approximately 250 feet below sea level. At various times, Lake Cahuilla has filled part of the trough. Evidence of this can be seen by ancient beach lines and silt deposits that surround the Salton Sea. On the west side of the trough, uplifted sediments of the former delta of the ancestral Colorado River form badlands. The park is situated across both these austere landscapes.

The Santa Rosa Mountains dominate the horizon northwest of the park. These mountains form the easternmost reaches of the Peninsular Ranges, and consist of granitic and metamorphic rock that was pushed up as the Salton Trough subsided to below sea level.

The deposits of the Imperial Formation, exposed at Shell Reef, indicate that seawater inundated the Salton Trough during the early Pliocene (4.2 to 5.3 million years ago). The Colorado River flowed into and built its delta in the ocean-filled trough. By the mid-Pliocene (4.2 million years), the Colorado River brought so much sediment that the delta become large enough to plug the trough and dam off the ocean. The course of the river shifted back and forth across the enormous delta, at times flowing into the ocean, and during other times filling the Salton Trough with a lake of fresh water and sediments. The layers of sediments, known collectively as the Palm Springs Group, occur within the park. The latest filling formed ancient Lake Cahuilla 300 years ago and dried up before the late 1800s. The Palm Springs Group sediments are topped with more recent sediments. These sediments consist of the coarse-grained alluvium derived from the Santa Rosa Mountains, and fine-grained deposits from the ancient lake. These sedimentary deposits comprise the bulk of the geologic materials that underlie the park.

Concretions

An eye-catching feature of the rocks of the Palm Springs Group is the numerous round concretions that weather out of some layers. Although common in the surrounding region, concretions are relatively rare sedimentary features. Pumpkin Patch hosts many cannonball sized concretions. Concretions exhibit a vast variety of shapes and sizes. They are thought to form during the process through which sediment turns to rock called lithification. For sediments to lithify, some cementing agent must circulate in solution through the deposits to bond the individual grains together into a solid mass. Calcium carbonate from circulating groundwater is a common cementing agent. Concretions form where the cementing agent preferentially accumulates and deposits around some nucleus that could be mineral grains or organic matter. Because the concretions are preferentially cemented compared to the rock that encases them, they better resist erosion and stand out against the softer matrix.

What you can see: Oases, concretions, fossil marine shells, historic lake bed.

Lake Cahuilla Shoreline

The ancient shoreline of prehistoric Lake Cahuilla crosses the park and is important from a geological as well as an archeological perspective. The shoreline roughly coincides with the 42-foot elevation contour.

Geologically, the shoreline represents the most recent high-stand of prehistoric Lake Cahuilla. The lake gradually evaporated within the last several centuries. The lake is intimately tied to the fluctuations of the mouth of the Colorado River. The Salton Sea, which occupies a small portion of the Lake Cahuilla basin, is the result of an accidental diversion of the Colorado River in 1916. The deposits of Lake Cahuilla exposed in the park consist of a whitish, dry mud with ubiquitous shells and silty/sandy shoreline deposits. In geologic terms, the deposits are recent.

Archeologically, the shoreline represents the locus of prehistoric inhabitation by the Cahuilla Indians. Fish traps, trails, and other artifacts reveal how the Native Americans utilized the lake shore. The shoreline is approximately 280 miles long, but has been altered by development in many areas.

Final Thoughts

There's something brewing beneath this park. The multitudes of shallow earthquakes and high geothermal energy promise an interesting geologic future.

Written by Mike Fuller, California Geological Survey
Photos: Cheryl Hayhurst (except where noted)

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