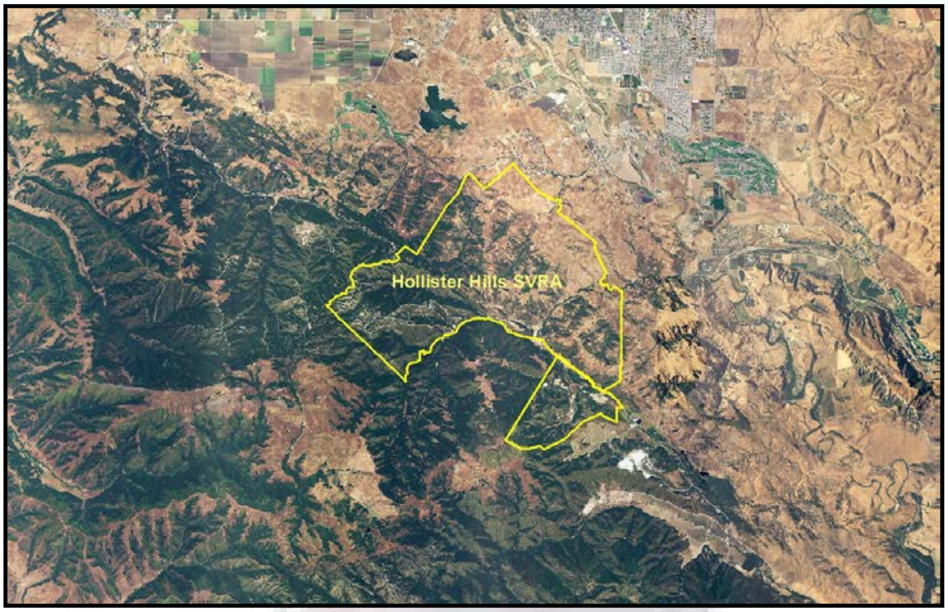
GEOLOGICAL GEMS OF CALIFORNIA STATE PARKS GeoGem 14

by Will Harris

Hollister Hills State Vehicular Recreation Area

PROCESS: Plate Tectonics

PLATES AND MARGINS: You may recall from an earth sciences class or a program on the Discovery Channel that the earth's crust is composed of tectonic plates that slowly slide over the earth's viscous, fluid mantel. These plates, composed of either oceanic crust or continental crust, meet in different ways. They may mash together, such as where the Indian plate has pushed into the Eurasian plate, creating the Himalayas. Or an oceanic plate may slip underneath another plate, creating a subduction-related volcanic arc, such as the Cascade Range, which stretches from northern California through Oregon and Washington and into British Columbia, and includes Mount Saint Helens, among other active volcanoes. Or they may slide past each other along what's called a transform margin, such as along California's San Andreas Fault. South of the town of Hollister and due east of the Monterey Bay, within the hills and peaks of the Gabilan Range, the Hollister Hills State Vehicle Recreation Area (Hollister Hills) straddles a portion of the San Andreas Fault transform margin.



REARRANGED LANDSCAPE: The San Andreas Fault is a transform margin between the Pacific oceanic plate and the North American continental plate. It is also called a right-lateral strike-slip fault, where land on one side of the fault moves to the right relative to land on the other side.

Plate movement along this fault is of course exhibited by earthquakes, from small shakers to devastating events, such as the famed 1906 San Francisco quake. There are also portions of the fault where the plates quietly slide, or creep, past each other. This occurs on that portion of the San Andreas Fault which runs through Hollister Hills.

Fault creep sounds relatively innocuous. Indeed, fault creep meters installed at Hollister Hills have recorded movement of about one half inch for every year. But fault creep is relentless, and movement on the San Andreas Fault began millions of years ago. The resultant affect of the strike-slip movement, once it is recognized in the Hollister Hills landscape, is dramatic.

For instance, the northwest-southeast trace of the San Andreas Fault is delineated by the shallow, linear valley that stretches between the Lower Ranch and Upper Ranch areas of Hollister Hills.

Linear northwest-aligned hillocks within the valley, such as Radio Ridge in the Lower Ranch and the hills between Cienega Road and the grand prix track in the Upper Ranch, are landforms called shutter ridges, created by the slow seismic smearing between the plates. And drainages—both manmade and natural—that flow across the fault have been offset. A concrete canal at the DeRose Vineyards, just up Cienega Road, southeast from the Upper Ranch, displays more than three feet of right-lateral offset (The historic DeRose corking facility near the canal also straddles the fault and has been literally torn in two due to the plate movement. It has been retrofitted to function as two separate structures.) And Bird Creek, which flows northeast from the southern corner of the Lower Ranch, is diverted more than 4,000 feet southwest along the fault trace before continuing northeast near the main entrance of Hollister Hills on Cienega Road.

You may notice two differing landscapes at Hollister Hills. The topography is higher and steeper on the southwest side of the San Andreas Fault trace, and the vegetation is relatively dense and varied. On the other side of the trace, the topography is muted, softer, the hills more rounded and the vegetation more sparse, consisting mostly of oak woodland, scrub, and grasses. This too is the result of the slow northwest progression of the Pacific plate relative to the North American plate along the San Andreas Fault.

The higher and steeper hills southwest of the fault trace are underlain by granitic rock, with relatively minor amounts of metamorphic rock. The granitic rock is at least 145 million years old and is most likely the southern extension of the Sierran granitic intrusion—the rocks that comprise the spine of the Sierra Nevada Mountain Range. The rock beneath the rolling hills on the northeast side of the fault consist of much softer and younger siltstones and sandstones derived from sediments laid down in a near-shore environment. These rocks are approximately five to six million years old.

The soils that develop from the rock on one side of the fault trace are significantly different from the soils derived from the rock on the other side of the fault. The exposed rock and the related soil on either side of the fault trace present different management and maintenance challenges to the operation of an off-highway vehicle (OHV) facility.

In the granitic terrain, the rock is hard but may be brittle and easily crumbled (friable) where exposed. Its light colored soils are sandy and silty and drain well, but mostly lack cohesion due to an absence of clay. These soils are more vulnerable to erosion, particularly from runoff concentrated in a ditch or gully.

The younger sedimentary rock on the other (northeast) side of the San Andreas Fault crops out in few places because it quickly weathers to a dark brown to black, clay-rich soil. Roads and trails on this soil wear well because of the strong cohesion provided by the clay particles in the soil. However, these soils do not drain well, and after only a slight rainfall wheeled travel on this material quickly becomes a slippery, difficult affair.

The unique fault-related distribution of soil types at Hollister Hills underscores the importance of understanding the terrain of an OHV facility from below the ground on up. The two distinctly different soil types at Hollister Hills, juxtaposed because of shifting tectonic plates, present different design, management, and maintenance challenges for the OHV facility. The steepness and designed skill level of a trail, the number of drainage control features on the trail, the degree of needed trail maintenance, weather-related closures of the trail, etc., depend ultimately on whether the trail lies on one side of the San Andreas Fault or the other—on sandy soil or clay. And, as can be seen from an aerial photograph of the Hollister Hills region, the soil and terrain on either side of the fault provide different habitat for plants and animals—a critical consideration in the overall management equation for the OHV facility.

Finally, the geology of Hollister Hills presents a unique recreational choice to the OHV enthusiast—whether to conduct off-road thrill-seeking on the Pacific plate, the North American plate, or both.