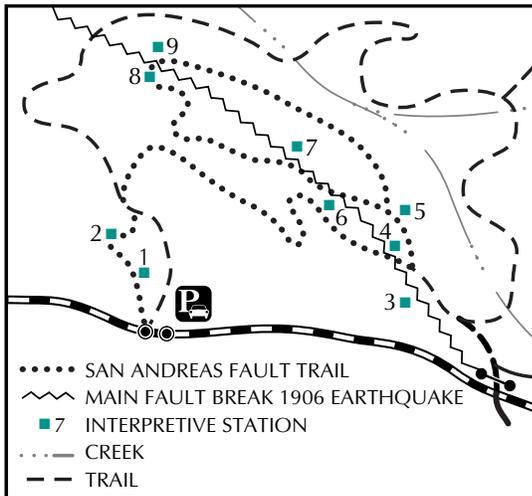


# San Andreas Fault Trail – A Self-Guided Earthquake Tour

## The San Andreas Fault Trail

Los Trancos Open Space Preserve is an ideal spot to learn about earthquake geology because the San Andreas Fault, one of the world's longest and most active faults, splits the preserve. The San Andreas Fault Trail was built for visitors, with the hope that the more one knows about their geologic environment, the better one will be able to protect themselves and their property against injury or damage from future earthquakes. The San Andreas Fault trail was established in 1977, with volunteer assistance from geology professor Tim Hall, Nick Hall, and Foothill College geology students.



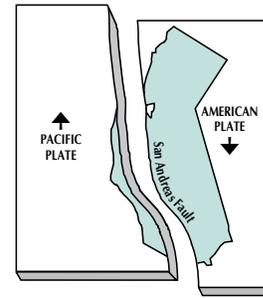
Numbered posts mark the interpretive stations as described in this brochure.



Posts with yellow bands mark the main fault break from the 1906 earthquake. Posts with white bands mark the minor fault breaks.

To understand how earthquakes happen, one must first look at how a fault, such as the San Andreas, is formed. The earth's interior is separated into three distinct layers: core, mantle, and crust. The earth's outer surface, or crust, is a jigsaw puzzle of 60-mile-thick plates of solid rock floating on a hot, plastic-like layer in the earth's upper mantle. The continents sit on 12 major plates that continue to slowly drift, collide, and reshape the face of our globe. The grinding of one plate against another forms a fault zone made up of crushed rock. On the preserve, the San Andreas fault zone is a 0.3-mile-wide belt where the Pacific plate is grinding northwestward against the American plate.

Friction prevents the two plates from sliding smoothly past each other, and causes tremendous energy to build up in the rocks deep within the earth. Ultimately, the stress will overcome the

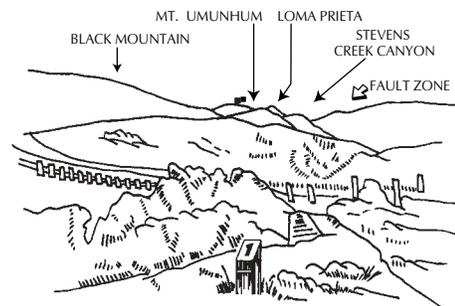


friction and the rocks will snap into new positions. This "snap" releases the accumulated energy in the form of a major earthquake, such as the San Francisco earthquake in 1906, or the Loma Prieta earthquake in 1989. Since the American and Pacific plates continue to try to move each year, as they have for millions of years, major earthquakes in the Bay Area are inevitable. The San Andreas Fault moves an average of 3/4 inch per year on the peninsula.

### Station 1

The trail starts on the left (western) side of the parking lot. Go through the fence and up the hill to Station No. 1.

Using the sketch below, try to identify Loma Prieta, a mountain 23 miles to the southeast near the site of the 1989 earthquake. Loma Prieta is located on the American plate, underlying most of North America and half of the Atlantic Ocean. Visitors are now standing on the eastern edge of the Pacific plate. The San Andreas Fault, located along Stevens Creek Canyon, is the boundary between the Pacific and American plates.



Look at the large boulders at one's feet. This particular type of rock, which is called a conglomerate, a sedimentary rock made of round pebbles, came from a unique source - the flanks of Loma Prieta, 23 miles away! About 2 million years ago, water carried these boulders from Loma Prieta westward across the San Andreas Fault and deposited them on the Pacific plate. Since then, successive slips along the San Andreas Fault have slowly shifted the Pacific plate in a northwesterly direction, bringing the boulders to their present position. There must have been about 12,000 major earthquakes in the time since these boulders tumbled downstream to bring them here.

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By looking at the landscape, visitors can find clues that they are in a fault zone. One clue is the shallow, but significant depression below, just north of the parking lot. In the winter, this depression, called a sag pond, catches water and becomes a marsh. Aside from human-made stock ponds, there are only two types of places in the coastal range where ponds are found: fault zones and landslide areas. This is because over time erosion occurs, filling in depressions and ponds. So, when one sees a pond in this area one knows it must have been created fairly recently. In this case, by the 1906 earthquake. Sag ponds like this one indicate that the earth's crust was stretched, allowing parts of the hillside to sink. Notice the line of posts with white stripes on the other side of the sag pond. They mark a minor fault within the San Andreas fault zone that moved slightly in 1906.

### Station 2

Visitors are standing in an unusual place along the San Andreas Fault. Although this area is in the fault zone, it is still elevated. The headwaters for Stevens Creek, which flows to the south, and Los Trancos Creek and Corte Madera Creek, which flow to the north, begin on this ridge. Typically, nature exploits weaknesses, such as the crushed or broken rocks found in the fault zone. These areas erode more quickly and are lower in the landscape - remember the Stevens Creek Canyon that marks the fault to the south. On the other hand, areas that are made of harder, less erodible material stand up high in the landscape.

From here, one can see the wide valley that delineates the fault to the north. Notice Crystal Springs Reservoir and San Andreas Lake, which are part of this well-defined valley. These reservoirs were built in the late 1800s to store water for San Francisco. Little did the engineers realize that the natural depressions that made this valley the perfect location to store water were created by an active fault!

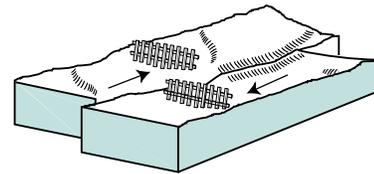
### Station 3

This picture was taken shortly after the 1906 earthquake. To get the same perspective, walk out to the end of the posts and look back in the direction from which one came. In the photograph, there are two cracks running along what is now a fairly flat road-like feature in the landscape. This is where the main active fault slipped during the 1906 earthquake. The cracks in the photograph are open. This means that there was not only lateral movement during the 1906 earthquake, but that the sides of the fault moved farther apart than they were before the quake. Since then, these cracks have filled in. Every time the ground ruptures, the sides of the fault will move farther apart and then fill in. This is why a flat area that resembles a roadbed can be seen. This feature is called a bench and is typically found along faults. Historically, these benches were often used as roadbeds.



### Station 4

This is how a fence built across the fault might have looked immediately after the 1906 earthquake. The fence has been reconstructed from century-old materials found on the preserve. An original section of this fence is still standing on the downhill side of the trail toward Los Trancos Creek. During the 1906 quake, faulting may have moved the far (right hand) segment as much as 3 feet in a northwesterly direction.



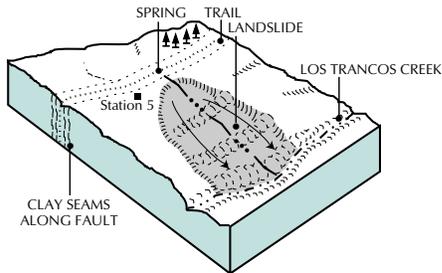
In 1906, about 400 miles of the San Andreas Fault slipped, from San Juan Bautista to Cape Mendocino. Starting off the Golden Gate, the fault unzipped itself at over 5,000 miles per hour, taking 20 seconds to reach this point. However, the northern part of the fault slipped much more than the southern part of the fault. The section north of the Golden Gate shifted about 15 to 16 feet, the section between San Francisco and Portola Valley shifted 7 to 9 feet, and from this area southward it only shifted 2 to 3 feet. The 1906 earthquake may not have released all the energy stored in the southern part of the fault. Smaller quakes, similar to the Loma Prieta, may have released the energy. In any case, energy is continuously being stored under our feet and we should be prepared for the results of its release.

### Station 5

Notice the willows and abundant brush to the left of the trail. These plants indicate that there is more water here than in other areas. Springs are often found along faults. As faults move, the rock in the fault is ground into a fine clay called fault gouge. The clay binds the crushed rock together and forms a barrier to the downhill flow of underground water. When underground water hits this clay barrier, the water builds up on the uphill side of the fault and eventually bubbles out of the ground, forming springs or wet spots.

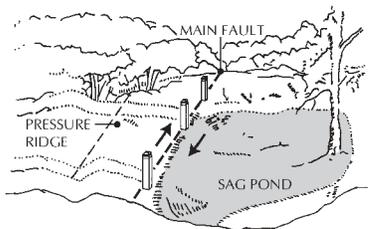
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When the ground becomes saturated with water, landslides are prone to occur, especially if the ground is shaken by a strong earthquake. Visitors can see that the area below the willows is a recovering landslide area. It is covered with poison oak, which often indicates a history of landsliding.



## Station 6

Having just crossed over the main fault again, one can see the prominent fault features - the sag pond at one's feet and the road-like bench upon which the fault markers are standing. The sag pond is filling in with sediment, and if one is here during the dry months, it probably looks like a shallow depression. The trail along which one just walked is on a slight ridge, higher than the sag pond. Rarely does one find ridges like this one running parallel to the contours, which are lines that connect two points that are at the same elevation. Usually these ridges follow the drainage down the hill. This is called a pressure ridge and is another fault feature.



## Station 7

From this point, one can see two oak trees in front of them, one on either side of the trail. Notice how the main trunks on these trees are growing parallel to the ground, with large limbs growing vertically—not a typical growth pattern.

The main trunks of these trees were cored, a process where a small plug of wood is removed to count the tree rings. The rings show that the main trunks date back to 1899. The vertical limbs are newer; they date back to 1908. These trees were quite possibly thrown to the ground by the shaking produced by the 1906 earthquake. Even so, there was enough root contact with the ground after the quake to allow the trees to survive. The branches started to sprout from the side and grow upwards toward the sunlight. The unusual shape of these trees is probably due to the 1906 quake.



## Station 8

Walking to the next station, notice the small valley that runs parallel to the contours. This landscape feature is another clue that something unusual is going on under one's feet. Normally, a valley like this is formed by draining water and generally heads downhill perpendicular to the contours. This anomaly tells one that either landsliding or faulting has occurred here. The posts mark a minor fault.

## Station 9

Look around. Can any unusual, fault-related landscape features be seen? Notice the road-like bench in front and to the left. Visitors are back at the main active fault. Imagine the amount of energy that is currently locked beneath one's feet!

## Earthquake Preparedness

People can prepare for an earthquake by doing a number of things. Assemble an earthquake disaster supply kit. Inspect one's home for items that could fall or break in an earthquake and secure them. Identify an out-of-state contact person for family members to contact if an earthquake occurs.

During an earthquake, protect one's self. If indoors, get under a table or desk and hold on until the shaking stops. Be alert for glass and other falling objects. If outdoors, stay away from buildings and trees that could fall. If in a car, stop the car away from trees and underpasses, and stay in it. Be aware that there will be aftershocks. Listen to the radio for emergency information.

The above earthquake preparedness information was provided by the American Red Cross. To obtain more information about earthquake preparedness, contact the local American Red Cross.

This is the end of the interpretive stations along the Fault Trail. To complete the loop, bear left at the next junction and return to the parking lot. If visitors are interested in exploring additional earthquake features, Monte Bello Open Space Preserve, across Page Mill Road, has excellent examples of sag ponds and active landsliding. The District also offers docent-led hikes. Please call the administrative office at 650-691-1200 to request the schedule for docent-led tours.