What is the San Andreas Fault?

By Becky Oskin

Live Science

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California's sleeping giant, the San Andreas Fault, marks the slippery yet sticky boundary between two of Earth's tectonic plates. It is responsible for the biggest earthquakes in California, up to at least magnitude 8.1.

**Beginnings**

The San Andreas Fault was born about 30 million years ago in California, where the North America plate meets the Pacific plate at a continuous, narrow break called a fault. Though there are many fractures and [faults](http://www.livescience.com/21486-earthquakes-causes.html) that mark the zone where the two plates slide past one each other, the San Andreas Fault is the main boundary between the two plates.

On the west side of the fault sits most of California's population, riding the Pacific Plate northwest while the rest of North America inches south. The Pacific Plate is moving to the northwest at 3 inches (8 centimeters) each year, and the North American Plate is heading south at about 1 inch (2.3 cm) per year.

Researchers have measured identical rocks offset by 150 miles (241 kilometers) across either side of the fault. For example, the volcanic rocks in Pinnacles National Park south of Monterey match volcanic rocks in Los Angeles County (called the Neenach volcanics). Geologists think the total amount of displacement along the fault is at least 350 miles (563 km).

## NorCal vs. SoCal

The San Andreas Fault is about 800 miles long (1,287 kilometers), stretching from the Mendocino coast south to the San Bernardino Mountains and the Salton Sea. Geologists divide the fault into northern and southern segments, separated in the middle by a curiously quiet portion that "creeps."

The northern segment runs from Hollister north through the Point Reyes National Seashore, then eventually moves offshore. The southern segment stretches from Parkfield south through the Salton Sea.

The central, creeping section includes everything from Parkfield to Hollister. In historical times, this [creeping section](http://www.livescience.com/37272-creeping-earthquakes-explained-san-andreas.html) has not generated powerful earthquakes similar to those on the "locked" sections.

That's because the creeping section continuously moves, while the locked sections seem to get stuck. These stuck sections of the fault store energy like springs, slowly building up strain until — sproing! — they suddenly unzip and slide past one another in an earthquake.

## Earthquake prediction

The San Andreas Fault is the site of a massive effort to drill into the Earth's crust and investigate a fault at depth. In 2004, work began near the town of Parkfield on the [San Andreas Fault Observatory at Depth](http://www.livescience.com/30737-san-andreas-fault-drill-project.html) (SAFOD) to drill nearly 2 miles (3.2 km) into the fault.

Parkfield, in central California, pops off a moderate earthquake of around magnitude 6 every couple decades, and is a center for earthquake research. It was the site of the first official earthquake prediction by the U.S. Geological Survey. Scientists predicted another earthquake should occur in 1993, but it didn't happen until 2004. Previous quakes hit in 1857, 1881, 1901, 1922, 1934 and 1966.

## Earthquake history

The largest earthquakes in California since European settlers arrived struck in 1857 and 1906 on the San Andreas Fault. The Jan. 9, 1857, Fort Tejon earthquake in southern California, an estimated magnitude 7.9, offset stream channels by as much as 29 feet (9 meters).

The April 18, 1906, San Francisco earthquake triggered a deadly fire in the growing city and killed some 700 people. The earthquake was an estimated magnitude 8.3 and broke the Earth's surface along a 250-mile length (402 km), from

Researchers worry that the southern section of the San Andreas fault [has not suffered a big earthquake for at least 300 years](http://www.livescience.com/30104-san-andreas-fault-earthquake-coachella.html). An event similar in size to the 1857 and 1906 earthquakes would substantially damage Palm Springs and other inland cities.

Experts say the southern portion of the fault is capable of triggering a magnitude 8.1 earthquake, by rupturing all the way from Parkfield to the Salton Sea.

**\*\*\*Writing Assignment: Write one paragraph answering the following question with evidence from the article: Why is California in danger of experiencing a large earthquake?**

**Powerful Quake and Tsunami Devastate Northern Japan**

By Martin Fackler

3/11/11

TOKYO — Rescuers struggled to reach survivors on Saturday morning as [Japan](http://topics.nytimes.com/top/news/international/countriesandterritories/japan/index.html?inline=nyt-geo) reeled after an earthquake and a tsunami struck in deadly tandem. The 8.9-magnitude earthquake set off a devastating tsunami that sent walls of water washing over coastal cities in the north. Concerns mounted over possible radiation leaks from two nuclear plants near the earthquake zone.

The death toll from the tsunami and earthquake, the strongest ever recorded in Japan, was in the hundreds, but Japanese news media quoted government officials as saying that it would almost certainly rise to more than 1,000. About 200 to 300 bodies were found along the waterline in Sendai, a port city in northeastern Japan and the closest major city to the epicenter.

Thousands of homes were destroyed, many roads were impassable, trains and buses were not running, and power and cellphones remained down. On Saturday morning, the JR rail company said that there were three trains missing in parts of two northern prefectures.

While the loss of life and property may yet be considerable, many lives were certainly saved by Japan’s extensive disaster preparedness and strict construction codes. Japan’s economy was spared a more devastating blow because the earthquake hit far from its industrial heartland.

Japanese officials on Saturday issued broad evacuation orders for people living in the vicinity of two separate nuclear power plants that had experienced breakdowns in their cooling systems as a result of the earthquake, and they warned that small amounts of radiation could leak from both plants.

On Friday, at 2:46 p.m. Tokyo time, the quake struck. First came the roar and rumble of the temblor, shaking skyscrapers, toppling furniture and buckling highways. Then waves as high as 30 feet rushed onto shore, whisking away cars and carrying blazing buildings toward factories, fields and highways.

By Saturday morning, Japan was filled with scenes of desperation, as stranded survivors called for help and rescuers searched for people buried in the rubble. Kazushige Itabashi, an official in Natori City, one of the areas hit hardest by the tsunami, said several districts in an area near Sendai’s airport were annihilated.

The quake occurred in what is called a subduction zone, where one of the Earth’s tectonic plates is sliding beneath another. In this case, the Pacific plate is sliding beneath the North American plate at a rate of about three inches a year. The earthquake occurred at a depth of about 15 miles, which while relatively shallow by global standards is about normal for quakes in this zone, said Emily So, an engineer with the United States Geological Survey in Golden, Colo.

When such quakes set off a tsunami, the devastation often comes from a succession of waves, which can cross oceans at 500 miles per hour or more.

**\*\*Writing assignment: Write one paragraph answering the following question: What two naturals disasters recently occurred in Japan. How does one cause the other?**