Magnitude 6.0 SAN FRANCISCO BAY AREA

Sunday, August 24, 2014 at 10:20:44 UTC

USGS

Early Sunday morning, the Bay Area was awakened by a magnitude 6.0 earthquake, the biggest earthquake the region has experienced since the Loma Prieta earthquake nearly 25 years ago. The earthquake was centered 6 miles (10 km) south of the city of Napa, which is located about 50 miles northeast of San Francisco.

A building is partially collapsed due to a 6.0-magnitude earthquake, Sunday, Aug. 24, 2014, in Napa, Calif. A large earthquake rolled through California's northern Bay Area early Sunday, damaging some buildings, igniting fires, knocking out power to tens of thousands and sending residents running out of their homes in the darkness.

(AP Photo/Ben Margot)

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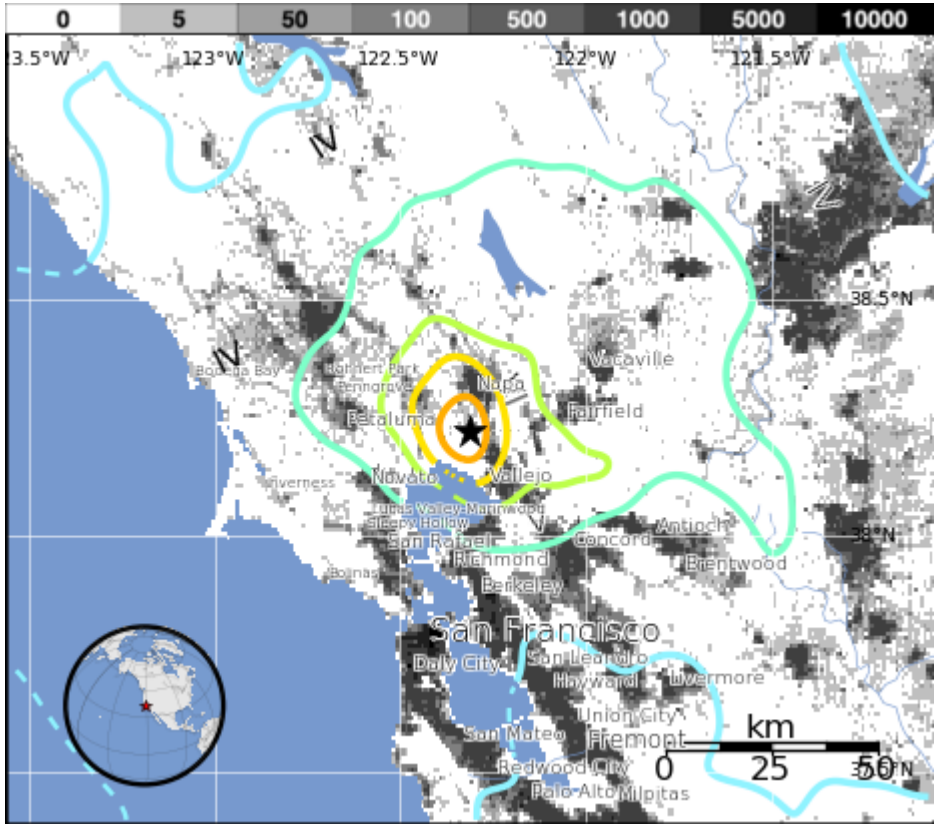
The USGS PAGER map shows the population exposed to different Modified Mercalli Intensity (MMI) levels.

66,000 people experienced severe shaking and over 760,000 experienced at least moderate shaking from this earthquake.

The color coded contour lines outline regions of MMI intensity. The total population exposure to a given MMI value is obtained by summing the population between the contour lines. The estimated population exposure to each MMI Intensity is shown in the table below.

Image courtesy of the US Geological Survey

USGS PAGER
Population Exposed to Earthquake Shaking



Estimated Modified Mercalli Intensity	I	II-III	IV	V	VI	VII	VIII	IX	X
Est. Population Exposure	--*	1,503k*	6,245k*	760k	157k	80k	66k	0k	0k
Perceived Shaking	Not Felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme

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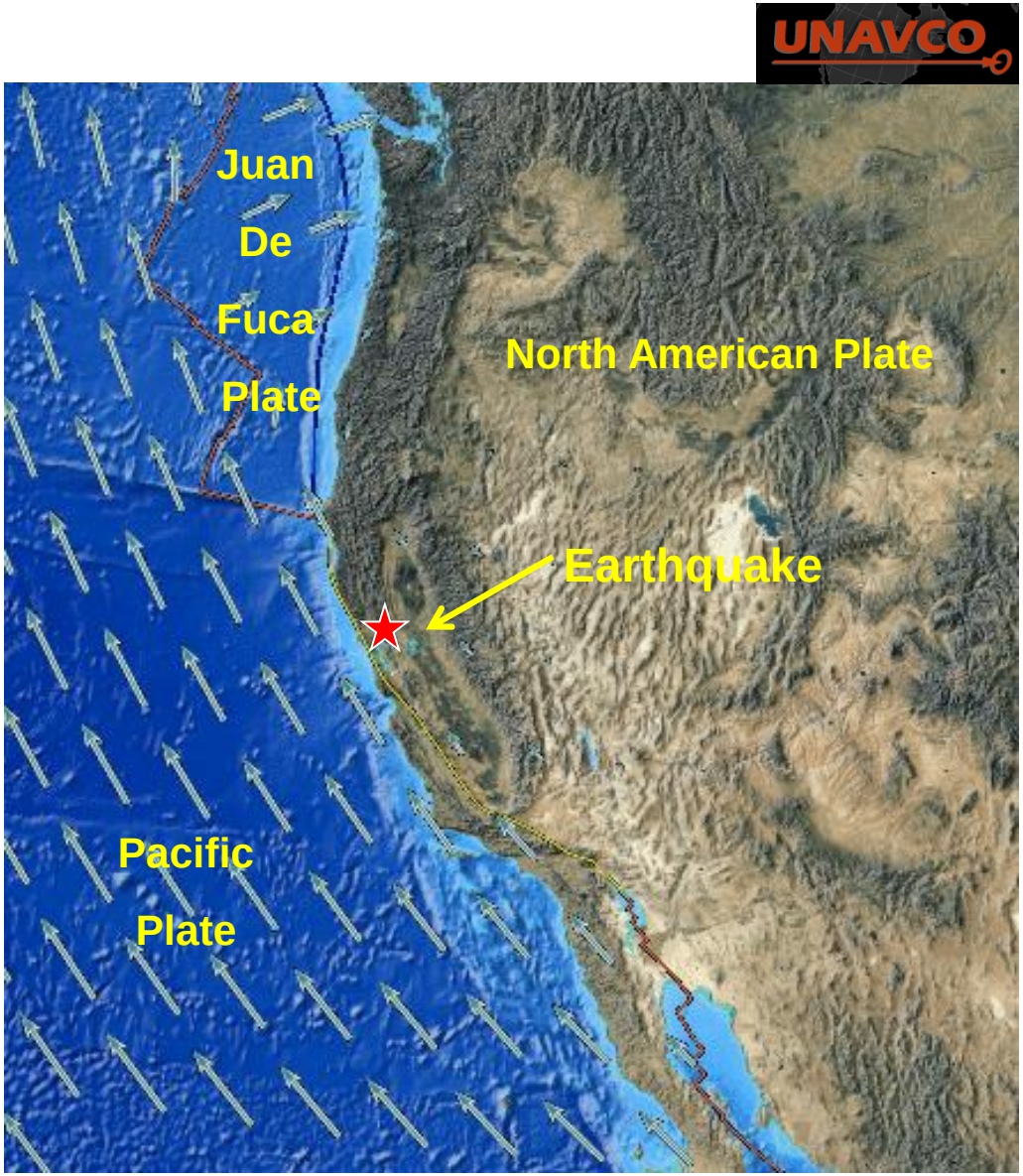
The epicenter of the earthquake is indicated by the red star.

This map also shows the rates and directions of motion of the Pacific and Juan de Fuca plates and with respect to the North American Plate. The rate of transform motion between the Pacific and North American plates is about 55 mm/yr (5.5 cm/year).

For comparison, the rate of subduction of the Juan de Fuca Plate beneath the North American Plate at the Cascadia subduction zone is about 35 mm/yr (3.5 cm/year).

This M6.0 earthquake is typical of moderate and shallow earthquakes on this transform plate boundary.



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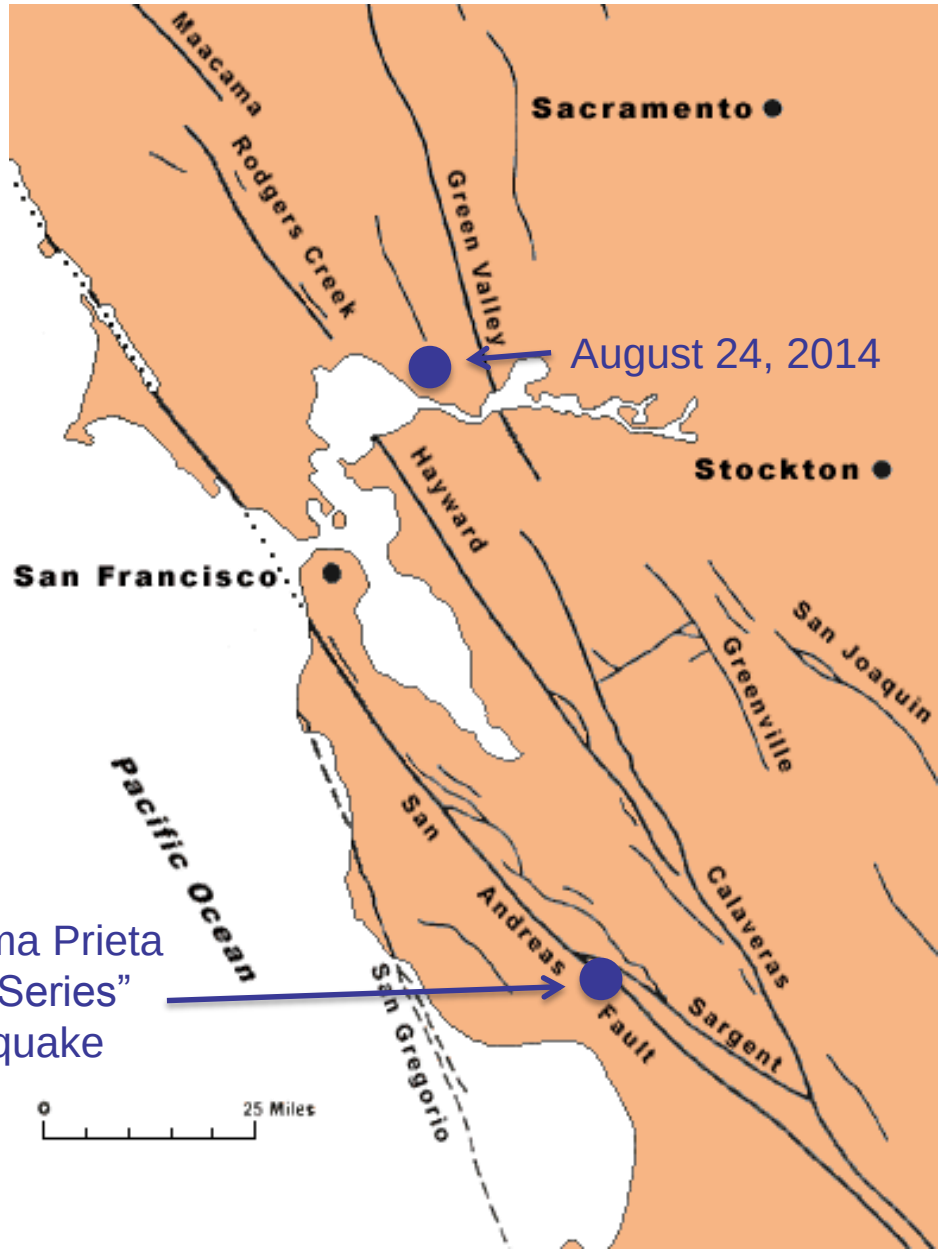
Faults in the San Francisco Bay Area

The earthquake lies within a 70-km-wide (44 miles) set of major faults of the San Andreas Fault system that forms the boundary between the Pacific and North American Plates. The state geologist with the California Department of Conservation said the earthquake most likely occurred along the West Napa Fault in Napa County.

The earthquake was the strongest to hit the Bay Area since 1989, when a 6.9-magnitude struck during the World Series.

The persistent northwestward movement of the Pacific Plate relative to North America primarily causes right-lateral slip across the major faults, but also causes deformation between the major faults.



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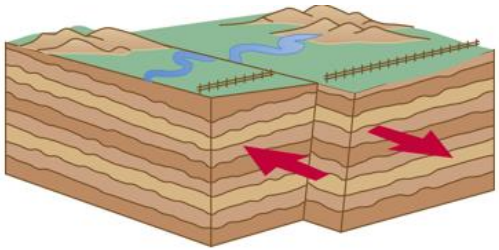
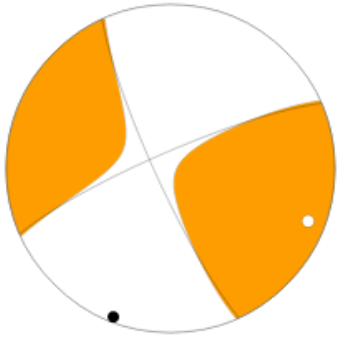
The map on the right shows regional historic earthquake activity since 1989 roughly aligned along northwest-southeast trending faults.

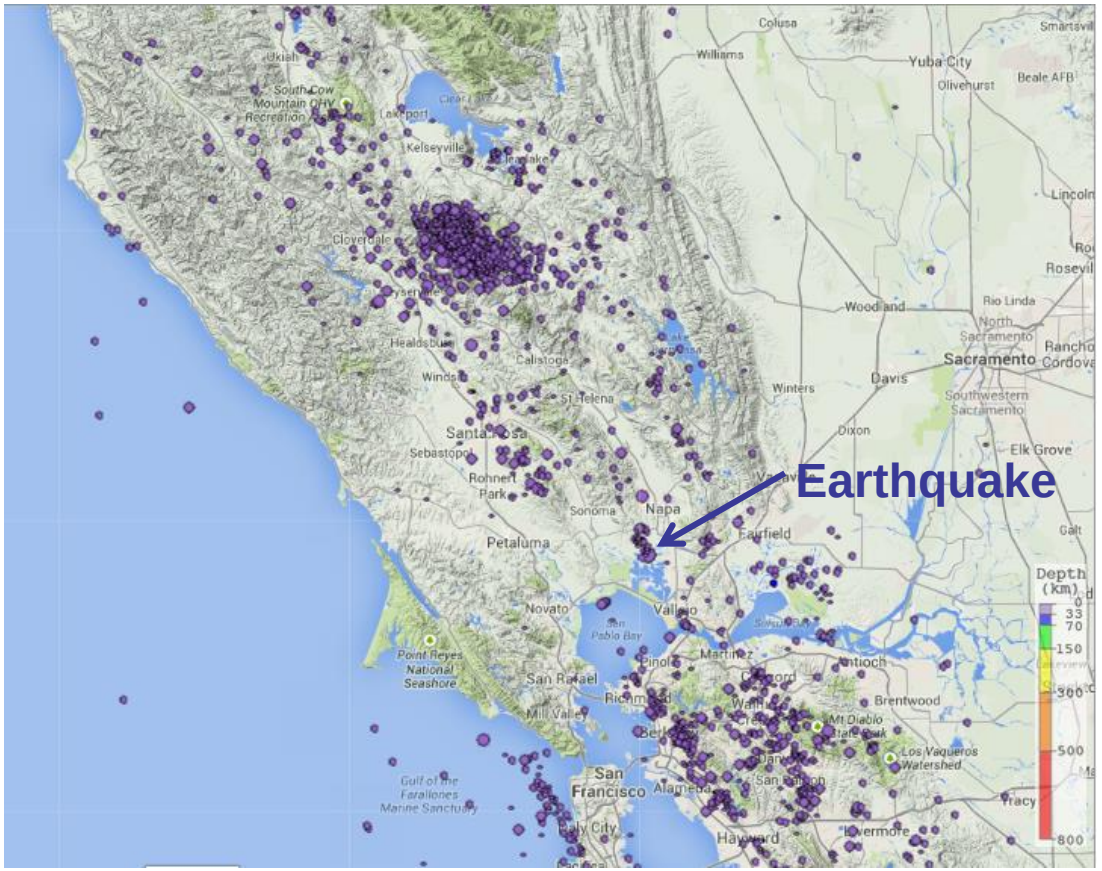
Today's earthquake was a result of strike-slip faulting.



strike-slip fault



USGS Centroid Moment Tensor Solution



explore at www.iris.edu/ieb

The tension axis (white dot) reflects the minimum compressive stress direction.
The pressure axis (black dot) reflects the maximum compressive stress direction.

Images courtesy of the U.S. Geological Survey

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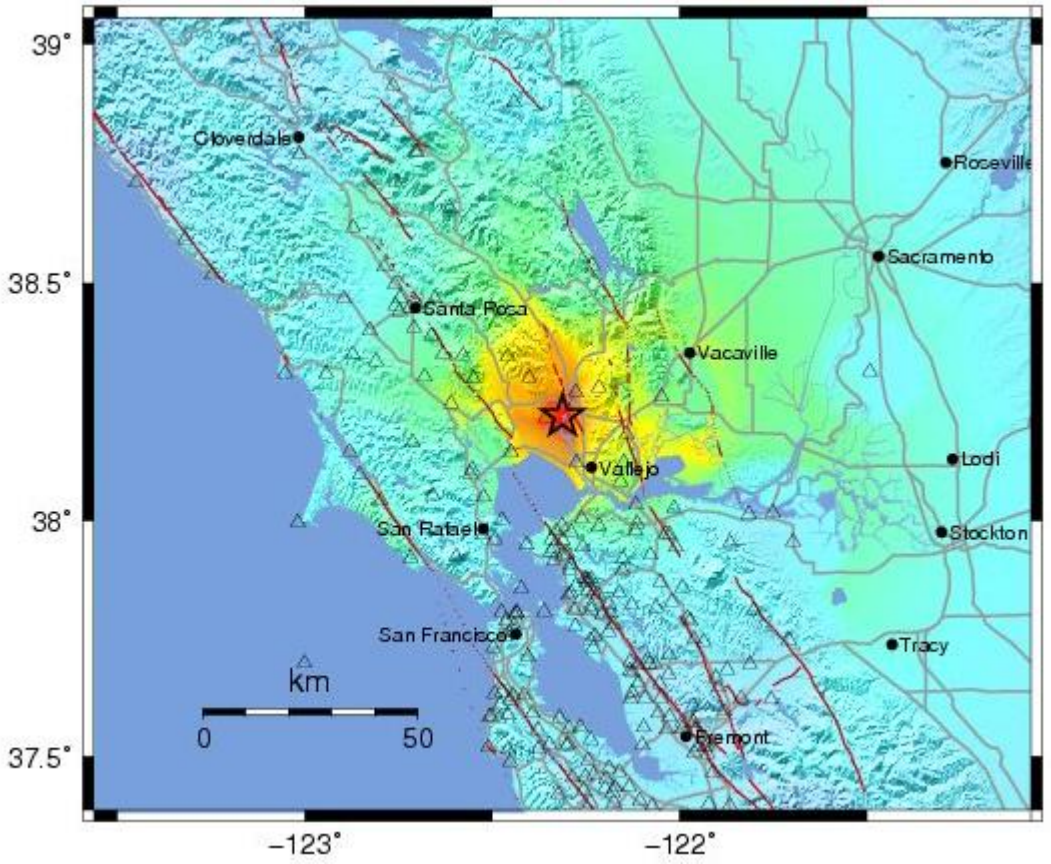
The Modified-Mercalli Intensity scale is a twelve-stage scale, from I to XII, that indicates the severity of ground shaking. The earthquake occurred near the north shore of San Pablo Bay. The bayshore areas in the San Francisco Bay region are underlain by landfill and bay mud and have experienced disproportionately greater damage during historic earthquakes. Such damage is caused by soil failure in the fills and amplification of ground shaking by the soft bay mud.

Modified Mercalli Intensity	Perceived Shaking
X	Extreme
IX	Violent
VIII	Severe
VII	Very Strong
VI	Strong
V	Moderate
IV	Light
II-III	Weak
I	Not Felt



USGS Estimated shaking Intensity from M 6.0 Earthquake

Image courtesy of the US Geological Survey

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The 1989 Loma Prieta earthquake caused 63 deaths, 3,757 injuries and an estimated $6 billion in property damage (buckled highways and destroyed homes), according to the USGS. There is a dramatic intensity difference between these two earthquakes. Ground motion amplitude increases by a factor of 10 with an increase of 1.0 in magnitude while earthquake energy increases by factor of 32 with each increase of 1.0 in magnitude.

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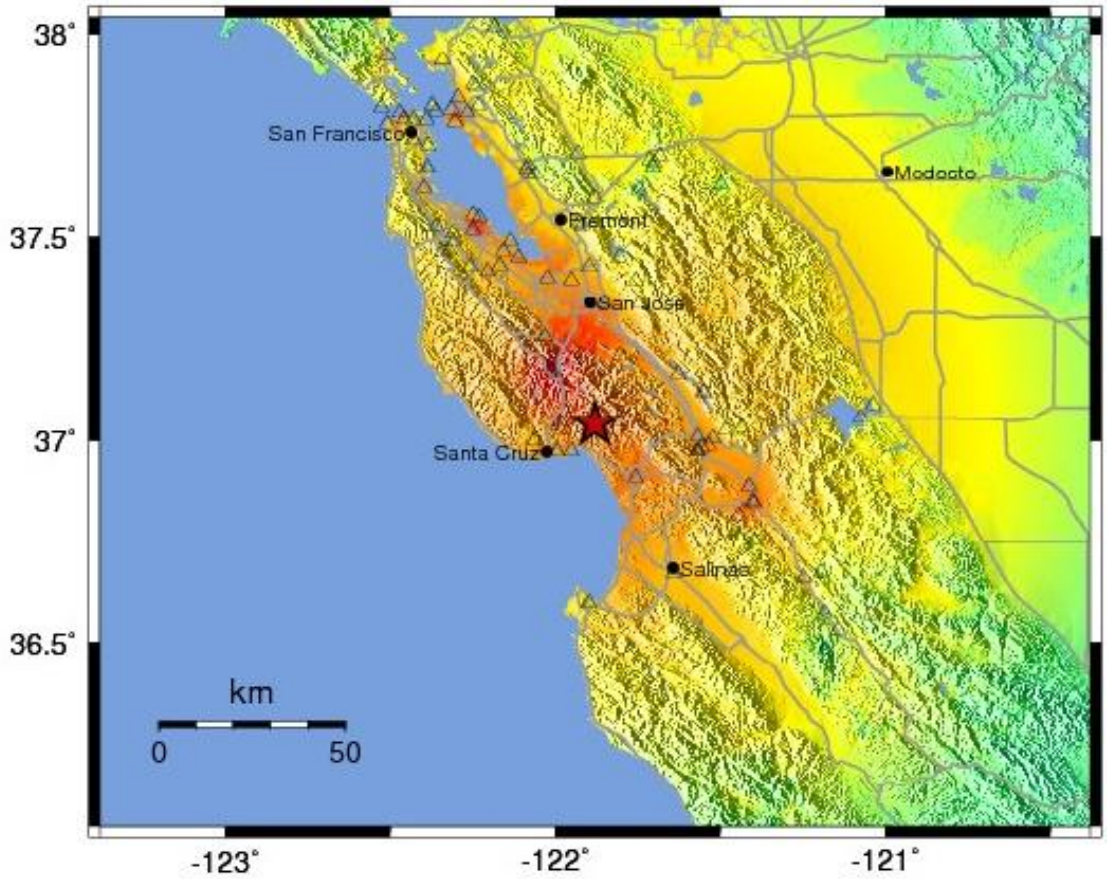

USGS Estimated shaking Intensity from M 6.9 Loma Prieta Earthquake

Image courtesy of the US Geological Survey

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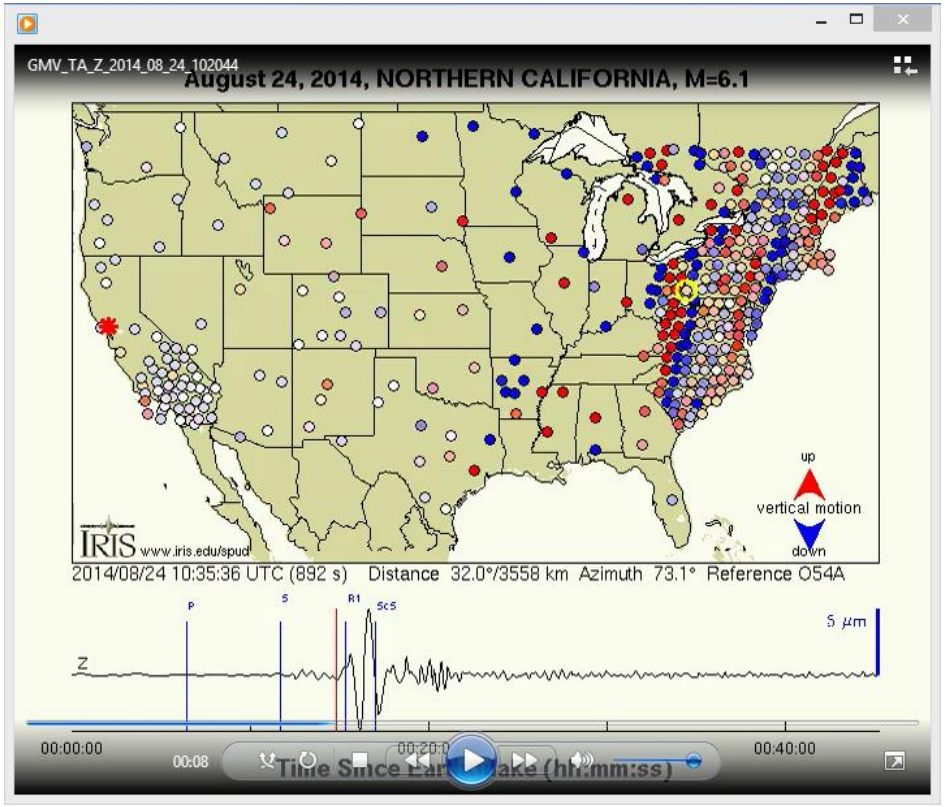
As earthquake waves travel along the surface of the Earth, they cause the ground to move. With the 400 earthquake recording stations in EarthScope's Transportable Array, the ground motions can be captured and displayed as a movie, using the actual data recorded from the earthquake.

The circles in the movie represent earthquake recording stations and the color of each circle represents the amplitude, or height, of the earthquake wave detected by the station's seismometer.

A random representative trace is displayed on the lower part of the animation with its horizontal axis representing the time (in seconds) after the event. Location of the representative station is marked on the map by a yellow circle.



Seismic waves crossing the US recorded by the USArray

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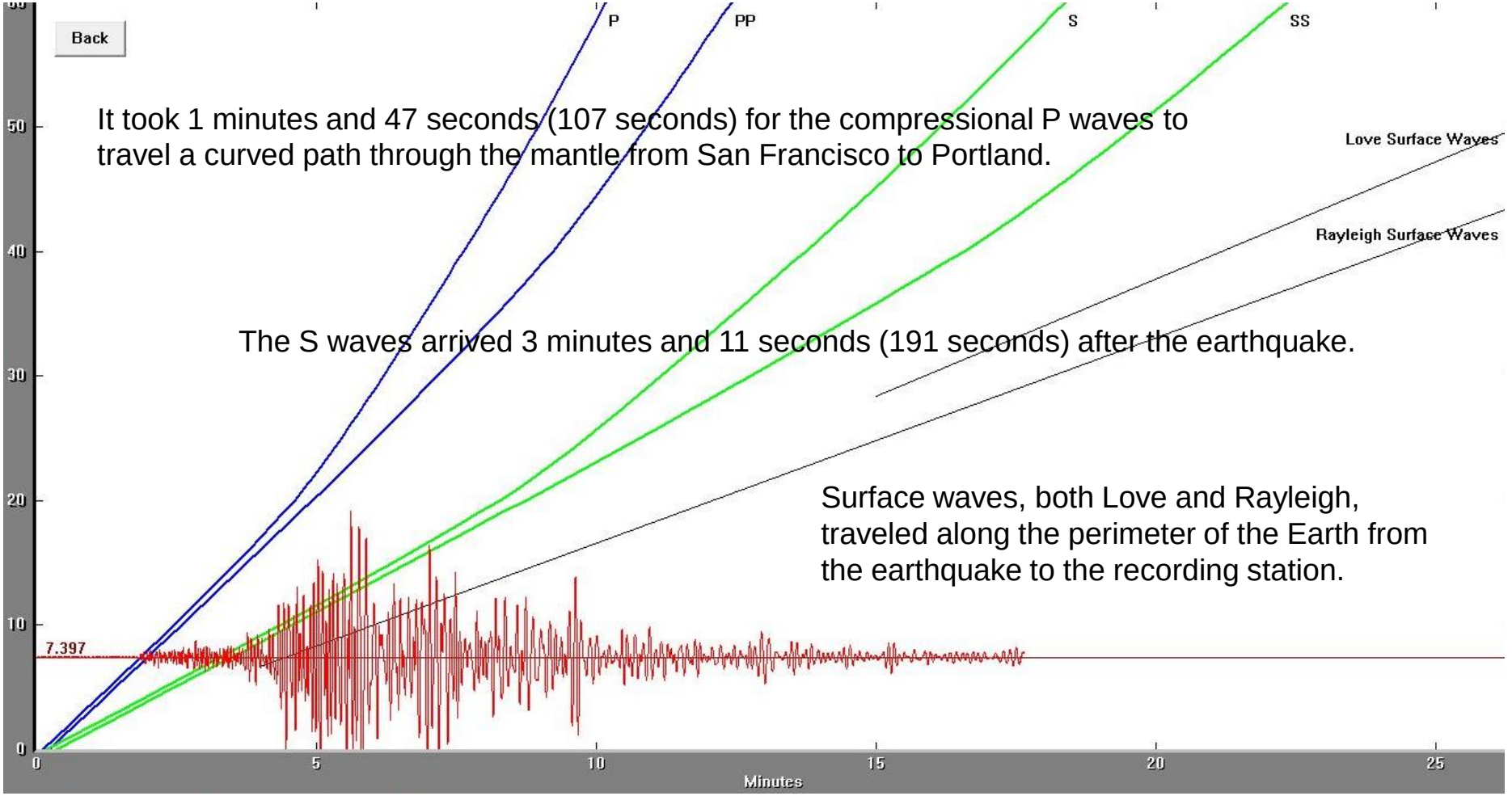
The record of the Napa earthquake on the University of Portland AS-1 seismometer is illustrated below. Portland is about 821 km (510 miles, 7.4 degrees) from the location of this earthquake.



It took 1 minutes and 47 seconds (107 seconds) for the compressional P waves to travel a curved path through the mantle from San Francisco to Portland.

The S waves arrived 3 minutes and 11 seconds (191 seconds) after the earthquake.

Surface waves, both Love and Rayleigh, traveled along the perimeter of the Earth from the earthquake to the recording station.

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Teachable Moments are a service of

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