Magnitude 7.1 PUEBLA, MEXICO
Tuesday, September 19, 2017 at 18:14:39 UTC

A magnitude 7.1 earthquake has occurred 120 km SE of Mexico City collapsing buildings, homes, and bridges across hundreds of miles. Nearly 140 people had been reported killed across the country, but that figure was expected to climb as rescue and recovery proceeds.

This earthquake occurred on the 32nd anniversary of the devastating 1985 M8.0 Michoacan earthquake, which caused extensive damage to Mexico City and the surrounding region.

A car sits crushed, engulfed in a pile of rubble from a building felled by a 7.1 earthquake, in Jojutla, Morelos state, Mexico. The earthquake stunned central Mexico, killing at least 139 people as buildings collapsed in plumes of dust. (AP Photo/Carlos Rodriguez)

Magnitude 7.1 PUEBLA, MEXICO
Tuesday, September 19, 2017 at 18:14:39 UTC

Mexico City is prone to major damage in earthquakes because it sits on an old lake bed. Portions of the city are built on young unconsolidated sediments where seismic waves are amplified. This earthquake caused heavy and prolonged shaking in the capital. While building standards have improved over the years, there are many old buildings in the city.

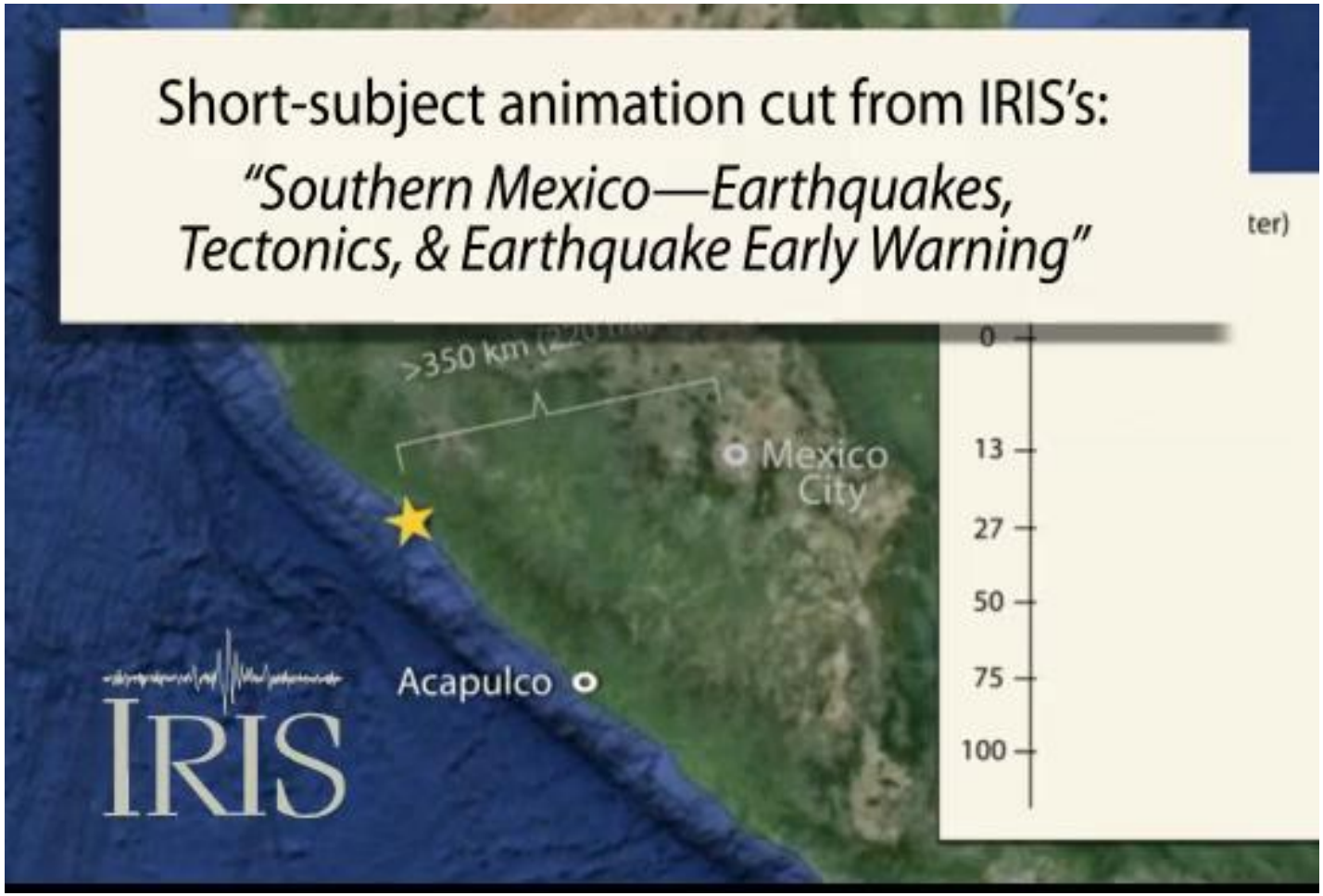
Mexico City

The capital of the Aztec empire was Tenochtitlan, built on an island in Lake Texcoco. Mexico City was built by the Spanish on the ruins of Tenochtitlan. Both the Aztecs and the Spaniards extended the island; the Aztecs first to create fertile land for planting, and the Spaniards eventually draining the lake to allow the city to grow.

Tenochtitlan- from *The Broken Spears*, Miguel León-Portilla

Magnitude 7.1 PUEBLA, MEXICO
Tuesday, September 19, 2017 at 18:14:39 UTC

Exploring shaking intensity in Mexico City from the 1985 earthquake.



(*Extracted from: http://www.iris.edu/hq/inclass/animation/235*)

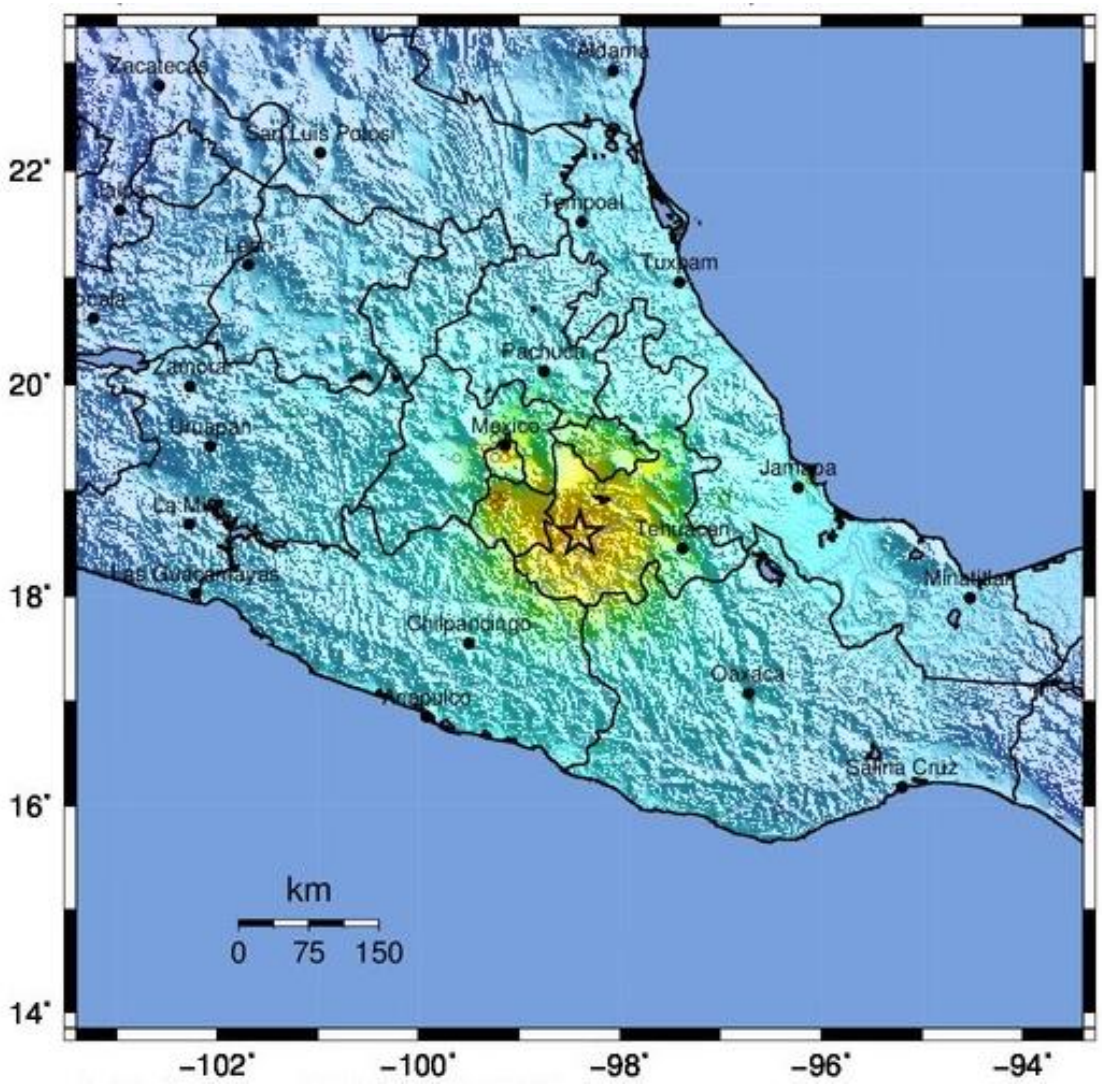
Magnitude 7.1 PUEBLA, MEXICO
Tuesday, September 19, 2017 at 18:14:39 UTC

The Modified-Mercalli Intensity scale is a twelve-stage scale, from I to XII, that indicates the severity of ground shaking.

The area closest to the epicenter experienced very strong shaking from this earthquake.

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

Image courtesy of the US Geological Survey



USGS Estimated shaking intensity from M 7.1 Earthquake

Magnitude 7.1 PUEBLA, MEXICO
Tuesday, September 19, 2017 at 18:14:39 UTC

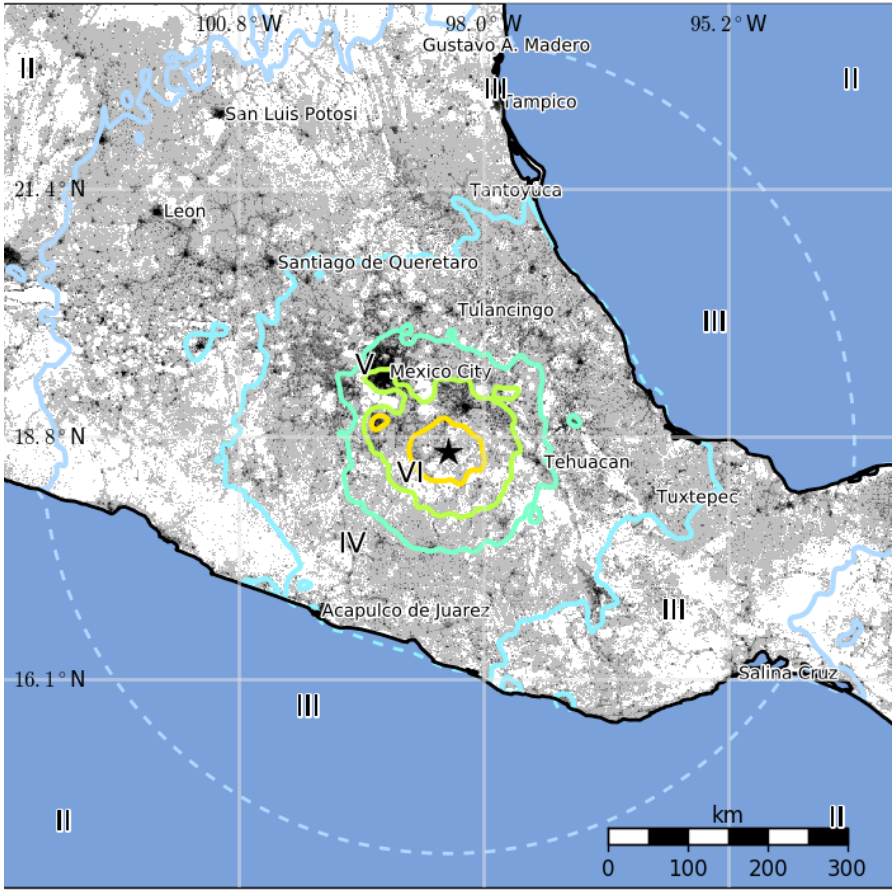
The USGS PAGER map shows the population exposed to different Modified Mercalli Intensity (MMI) levels.

The USGS estimates that over a million people felt very strong shaking and more than 15 million people felt strong shaking from this earthquake.

MMI	Shaking	Pop.
I	Not Felt	--*
II-III	Weak	27,583 k*
IV	Light	20,506 k
V	Moderate	14,501 k
VI	Strong	15,470 k
VII	Very Strong	1,615 k
VIII	Severe	0 k

USGS PAGER

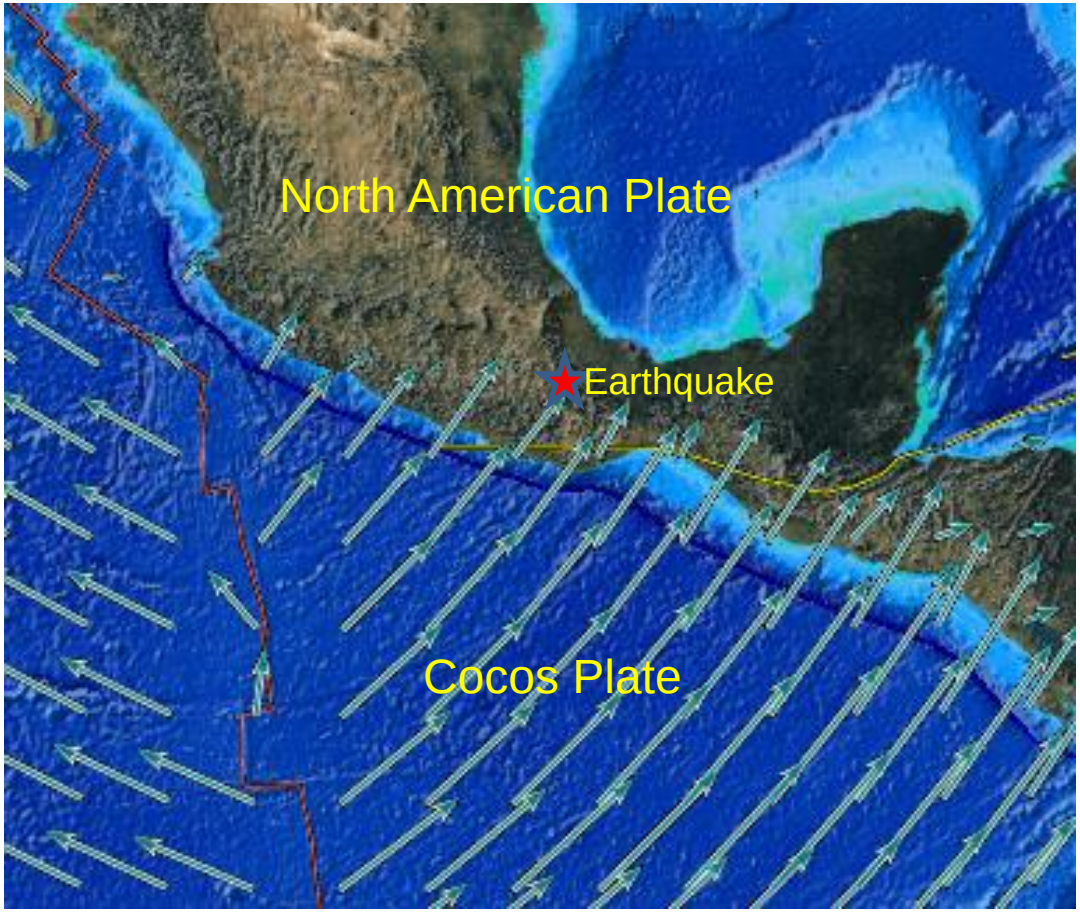
Population Exposed to Earthquake Shaking



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.

Image courtesy of the US Geological Survey

Magnitude 7.1 PUEBLA, MEXICO
Tuesday, September 19, 2017 at 18:14:39 UTC



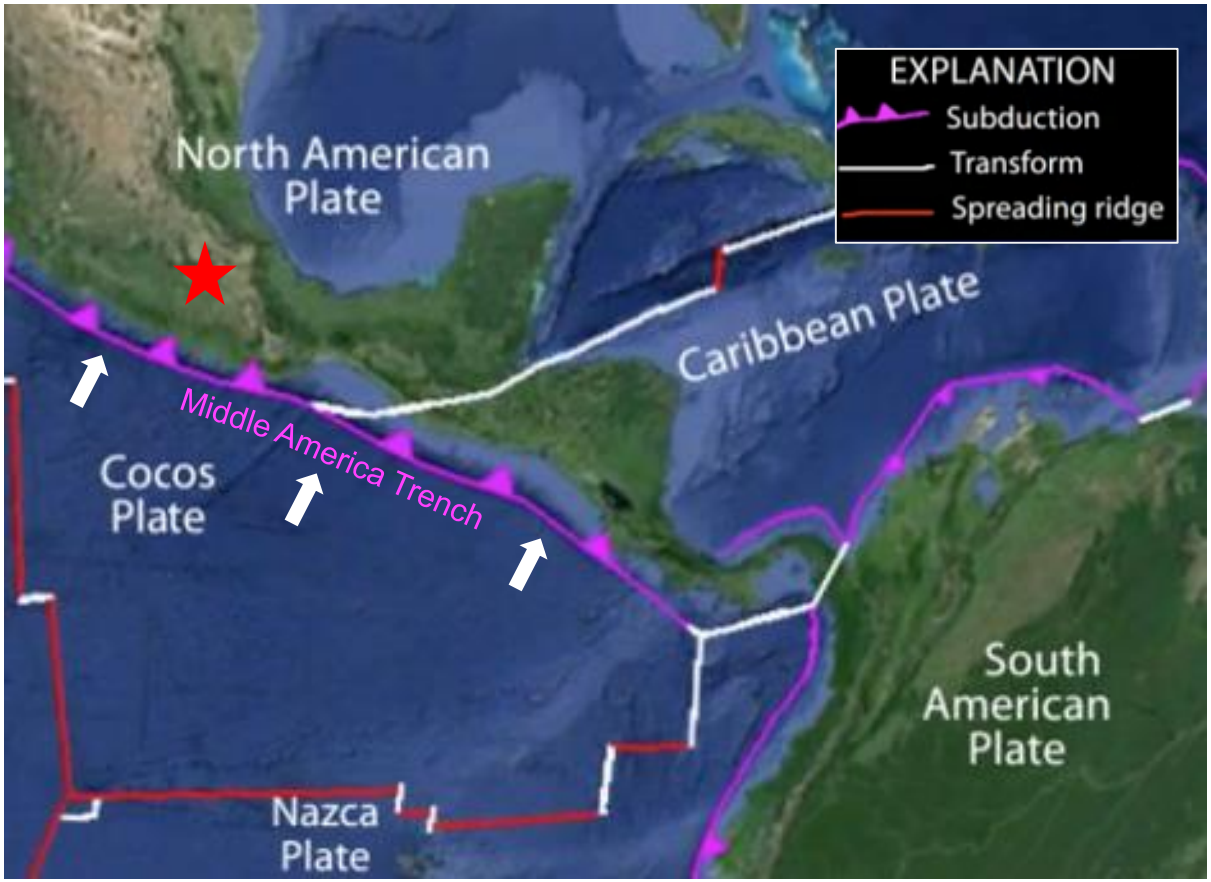
Arrows show plate motion relative to the North American Plate.

Mexico is one of the most seismologically and volcanically active regions on Earth. It is part of the circum-Pacific “Ring of Fire”.

Most of Mexico rests on the North American Plate. The Pacific Ocean floor off southern Mexico, however, is on the Cocos Plate. In the region this earthquake, the Cocos Plate moves northeastward at a rate of 76 mm/yr toward the North American Plate.

Magnitude 7.1 PUEBLA, MEXICO
Tuesday, September 19, 2017 at 18:14:39 UTC

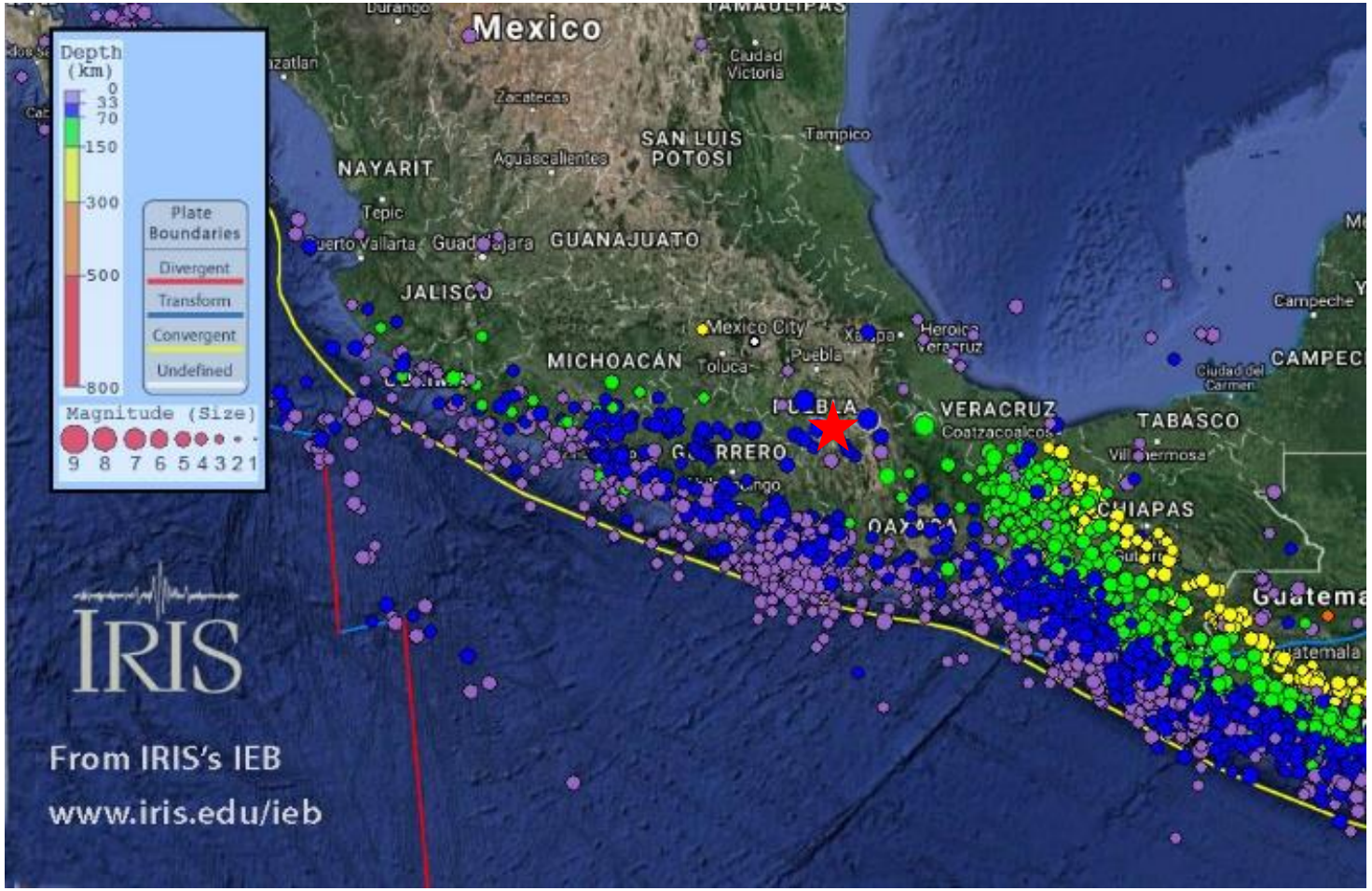
Red star shows the epicenter of this earthquake. In this region, the Cocos Plate subducts beneath the North American Plate along the Middle America Trench. The convergence rate in this part of the subduction zone is about 7.6 cm/yr. Many shallow interplate earthquakes on the Cocos - North American Plate boundary result from thrust faulting. However, this earthquake resulted from normal faulting at a depth of 51 km.



This depth indicates that the earthquake was an intraplate event within the top of the Cocos Plate. As oceanic plates descend into subduction zones from the seafloor, they must increase their curvature. This results in extensional forces and normal-faulting earthquakes within the upper portion of the subducting plate. The 2001 Nisqually earthquake is another example of a normal-faulting intraplate earthquake. That earthquake occurred at 51 km depth beneath the southern Puget Sound in Washington State due to extension within the subducting Juan de Fuca Plate.

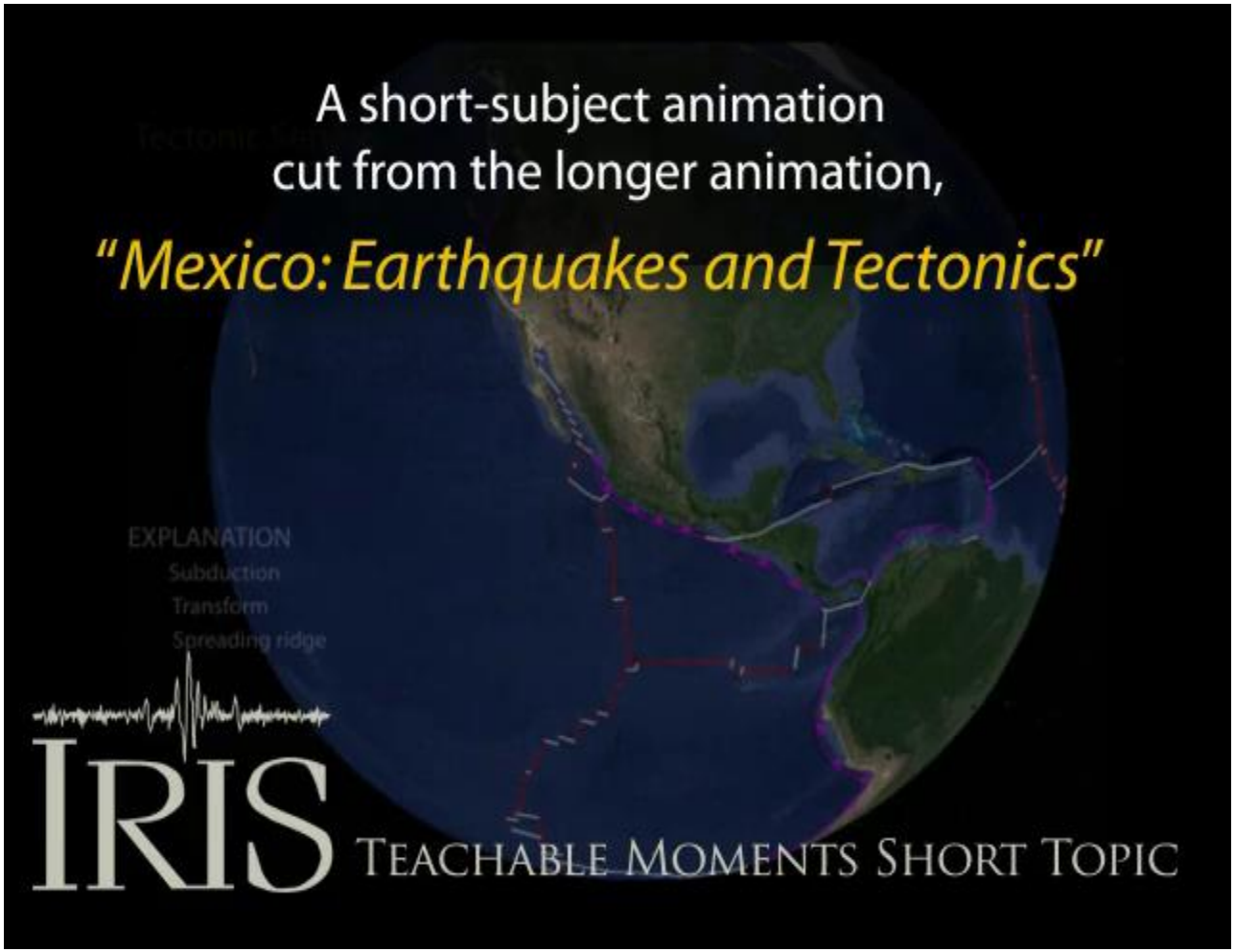
Magnitude 7.1 PUEBLA, MEXICO
Tuesday, September 19, 2017 at 18:14:39 UTC

This map of historic seismicity shows shallow earthquakes near the trench and deeper away from the trench. This earthquake is shown by the red star.



Magnitude 7.1 PUEBLA, MEXICO
Tuesday, September 19, 2017 at 18:14:39 UTC

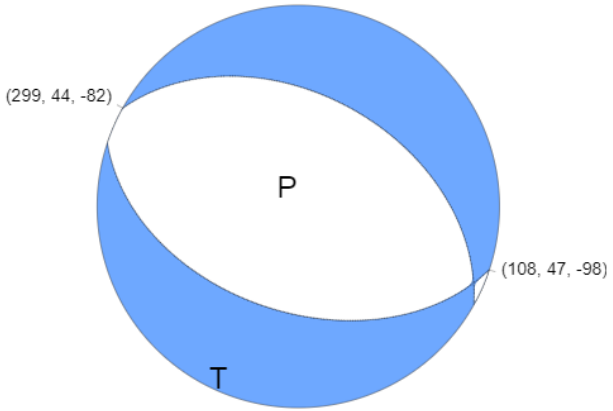
Animation of the regional tectonics of SW Mexico.



(*Extracted from: http://www.iris.edu/hq/inclass/animation/235*)

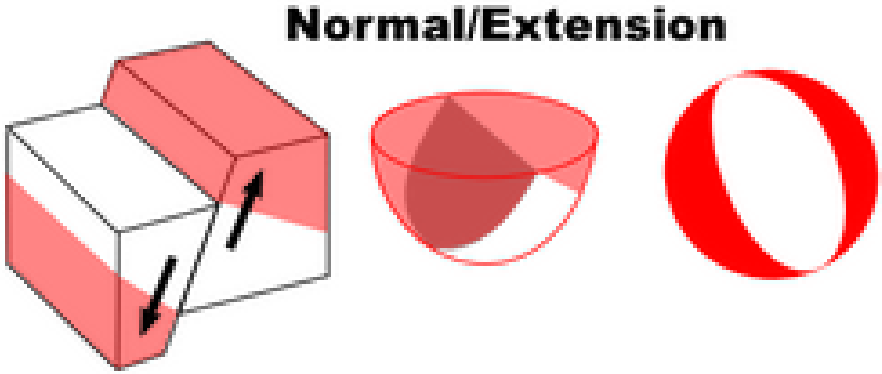
Magnitude 7.1 PUEBLA, MEXICO
Tuesday, September 19, 2017 at 18:14:39 UTC

The focal mechanism is how seismologists plot the 3-D stress orientations of an earthquake. Because an earthquake occurs as slip on a fault, it generates primary (P) waves in quadrants where the first pulse is compressional (shaded) and quadrants where the first pulse is extensional (white). The orientation of these quadrants determined from recorded seismic waves determines the type of fault that produced the earthquake.



USGS W-phase Moment Tensor Solution

The tension axis (T) reflects the minimum compressive stress direction. The pressure axis (P) reflects the maximum compressive stress direction.

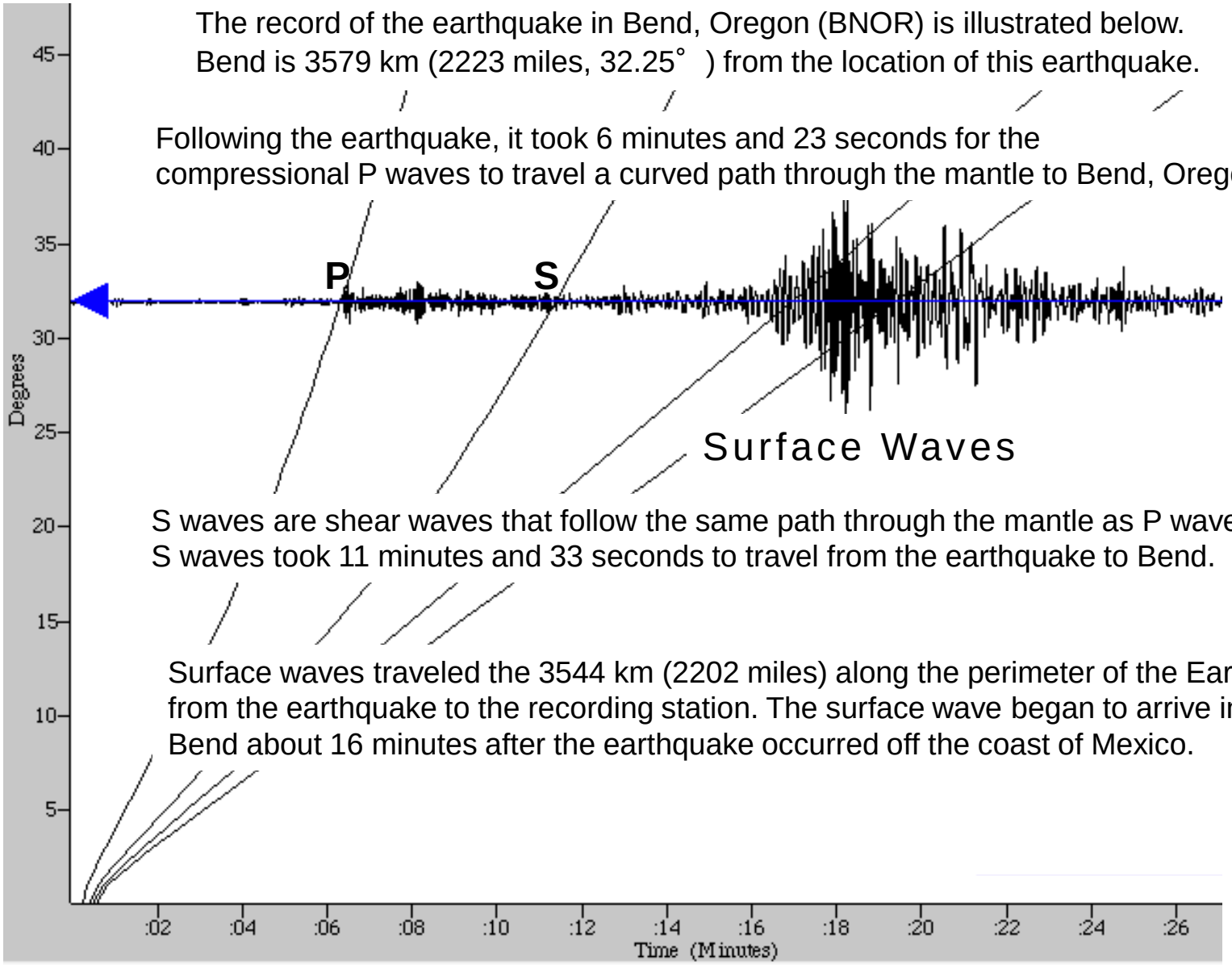


In this case, the focal mechanism indicates this earthquake occurred as the result of normal faulting.

Magnitude 7.1 PUEBLA, MEXICO
Tuesday, September 19, 2017 at 18:14:39 UTC

The record of the earthquake in Bend, Oregon (BNOR) is illustrated below. Bend is 3579 km (2223 miles, 32.25˚) from the location of this earthquake.

Following the earthquake, it took 6 minutes and 23 seconds for the compressional P waves to travel a curved path through the mantle to Bend, Oregon.



S waves are shear waves that follow the same path through the mantle as P waves. S waves took 11 minutes and 33 seconds to travel from the earthquake to Bend.

Surface waves traveled the 3544 km (2202 miles) along the perimeter of the Earth from the earthquake to the recording station. The surface wave began to arrive in Bend about 16 minutes after the earthquake occurred off the coast of Mexico.

Teachable Moments are a service of

The Incorporated Research Institutions for Seismology
Education & Public Outreach
and
The University of Portland

Please send feedback to tkb@iris.edu

To receive automatic notifications of new Teachable Moments subscribe at www.iris.edu/hq/retm

www.iris.edu/earthquake