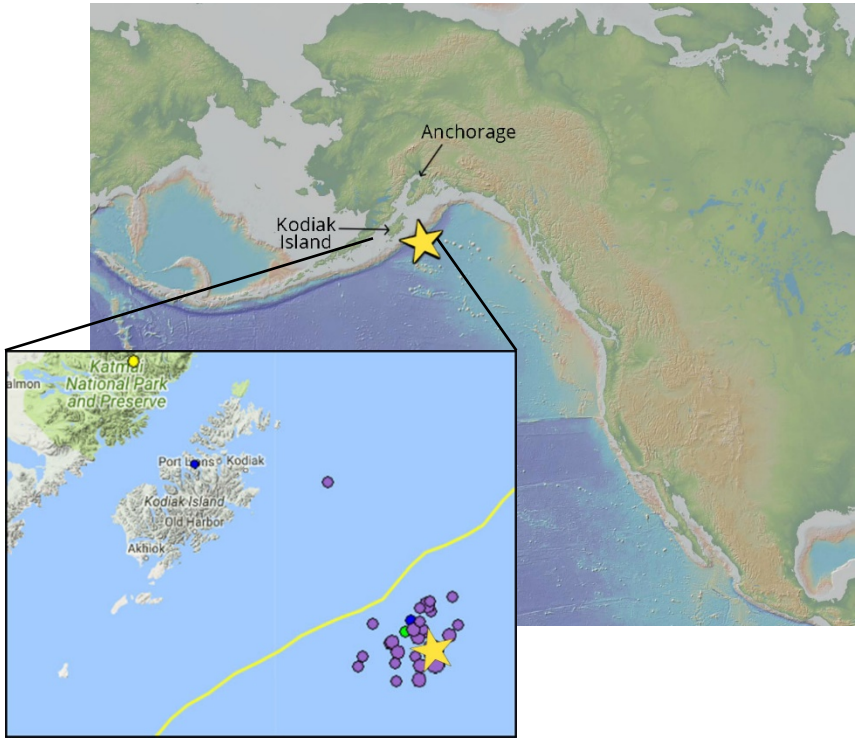
Magnitude 7.9 SE of KODIAK, ALASKA

Tuesday, January 23, 2018 at 09:31:42 UTC

A magnitude 7.9 earthquake occurred at 12:31 am local time 181 miles southeast of Kodiak at a depth of 25 km (15.5 miles). There are no immediate reports of damage or fatalities.



Light shaking from this earthquake was felt across southern Alaska. A tsunami alert activated emergency warnings along coastal Alaska, and roused much of the population to seek shelter or move from tsunami inundation zones.

This earthquake was a strike-slip earthquake which is not significantly tsunamigenic. While a wave height of less than eight inches was observed in a handful of Alaska cities, including Kodiak and Seward, the tsunami warning was eventually lifted.

While this earthquake did not generate a large tsunami, local landslide-generated tsunamis caused by earthquake ground shaking are a major hazard in Alaska. So evacuation to high ground is a proper response when ground shaking is felt.

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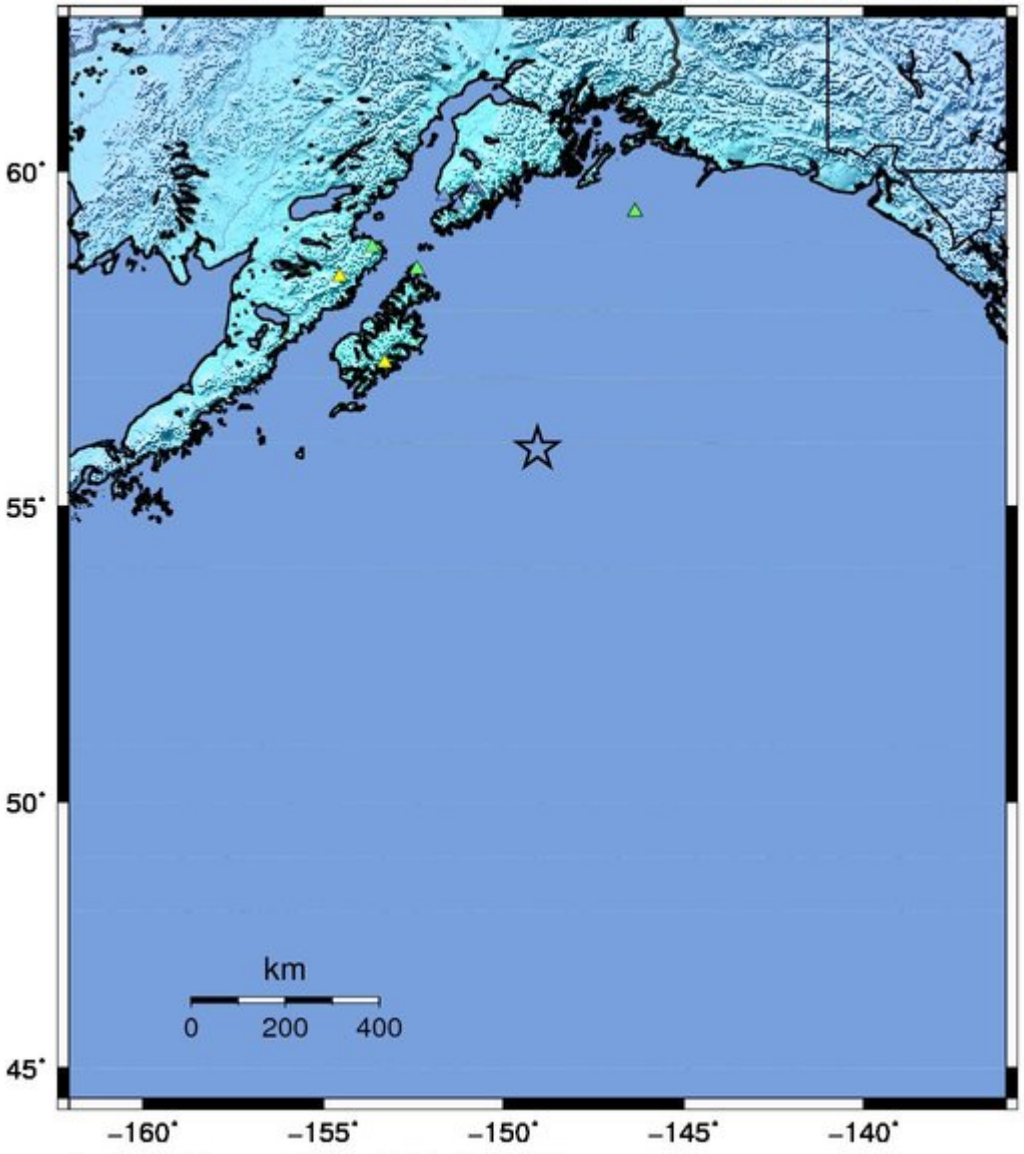
The Modified-Mercalli Intensity scale is a twelve-stage scale, from I to XII, that indicates the severity of ground shaking. Intensity is dependent on the magnitude, depth, bedrock, and location.

Light shaking from this earthquake was felt across southern Alaska.

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 7.9 Earthquake

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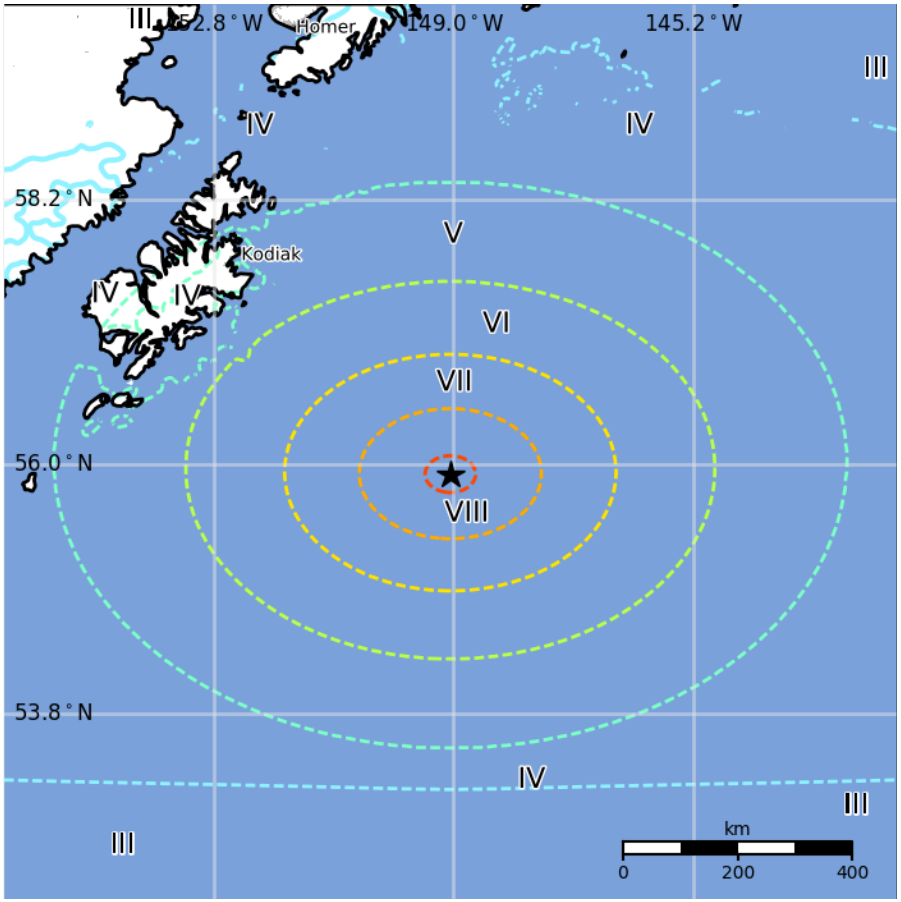
The USGS PAGER map shows the population exposed to different Modified Mercalli Intensity (MMI) levels.

The USGS estimates that over one hundred thousand people felt light shaking from this earthquake.

MMI	Shaking	Pop.
I	Not Felt	--*
II-III	Weak	279 k*
IV	Light	105 k*
V	Moderate	0 k
VI	Strong	0 k
VII	Very Strong	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

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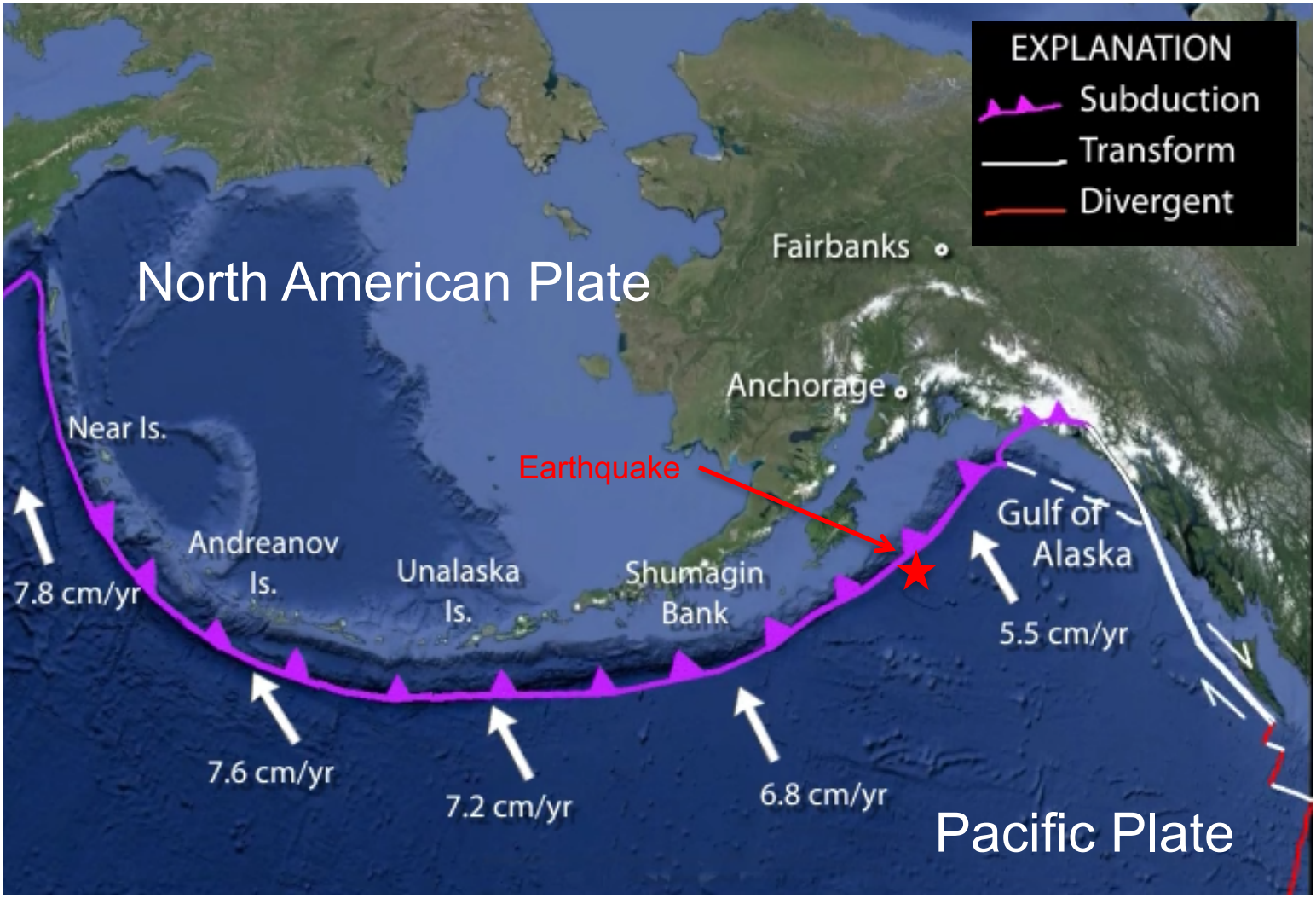

The Pacific Plate converges with, and subducts beneath the North American Plate and begins its decent into the mantle at the Alaska-Aleutian Trench just north of this earthquake. The rates of relative plate motion range from 5.5 cm/yr in the Gulf of Alaska to 7.8 cm/yr at the western end of the Aleutian Island chain. The rate of subduction in the location of this earthquake is about 5.9 cm/yr.

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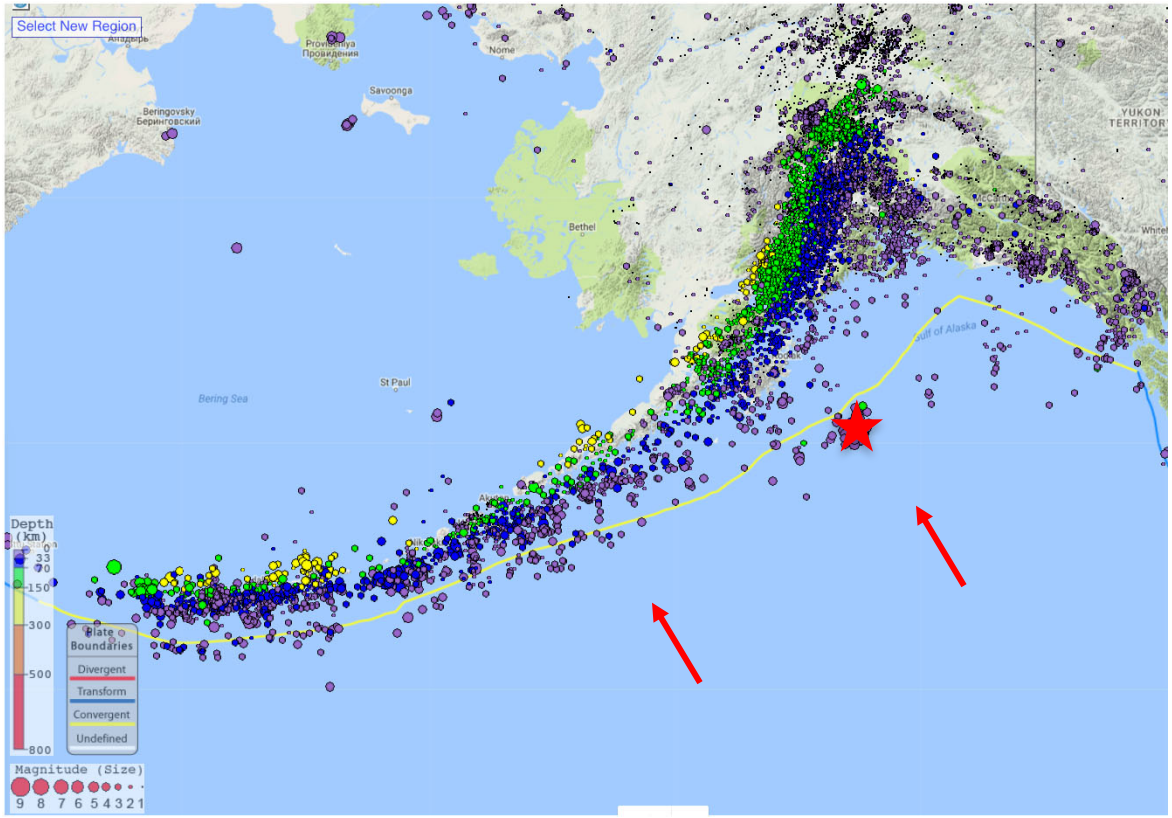
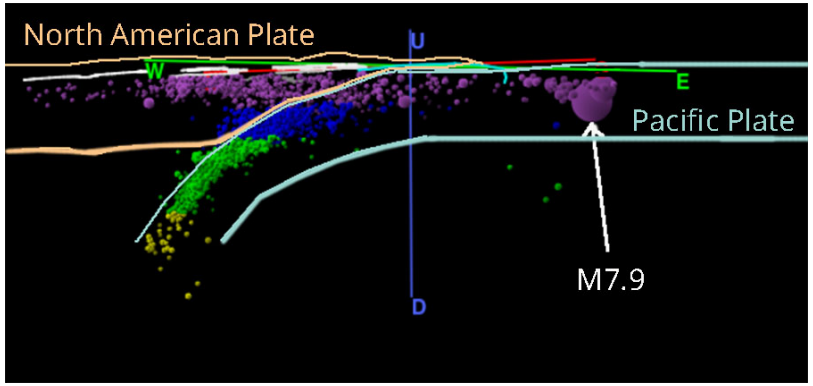
Epicenters are shown on a map of regional historic seismicity for earthquakes greater than magnitude 4 since 1978.

The cross section below, taken from the 3D function of IRIS' Interactive Earthquake Browser, shows earthquakes deeper than 70 km within the Pacific Plate as it subducts beneath the North American Plate.



Past 50 years of seismicity (1978-2018)



The earthquake occurred at a depth of 25 km, placing it within the oceanic lithosphere of the Pacific Plate.

Maps created from IRIS Earthquake Browser (www.iris.edu/ieb)

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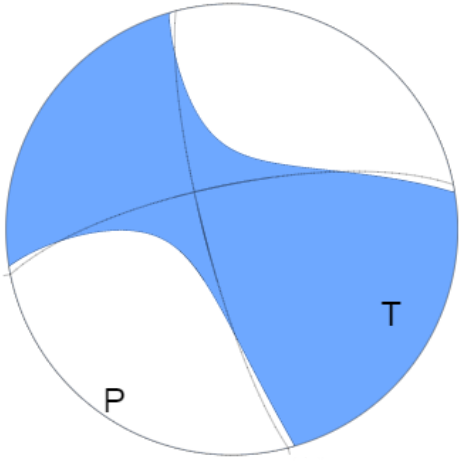
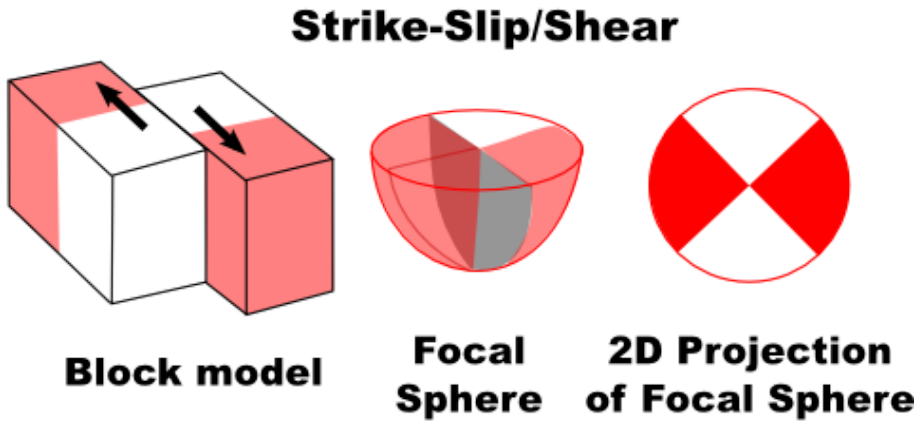
The focal mechanism is how seismologists plot the 3-D stress orientations of an earthquake. Because an earthquake occurs as slip on a fault, it generates primary (P) waves in quadrants where the first pulse is compressional (shaded) and quadrants where the first pulse is extensional (white). The orientation of these quadrants calculated 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 earthquake location and focal mechanism indicate it occurred on a strike-slip fault system within the Pacific Plate before it subducts, rather than on the plate boundary between the Pacific and North America Plates further to the northwest.

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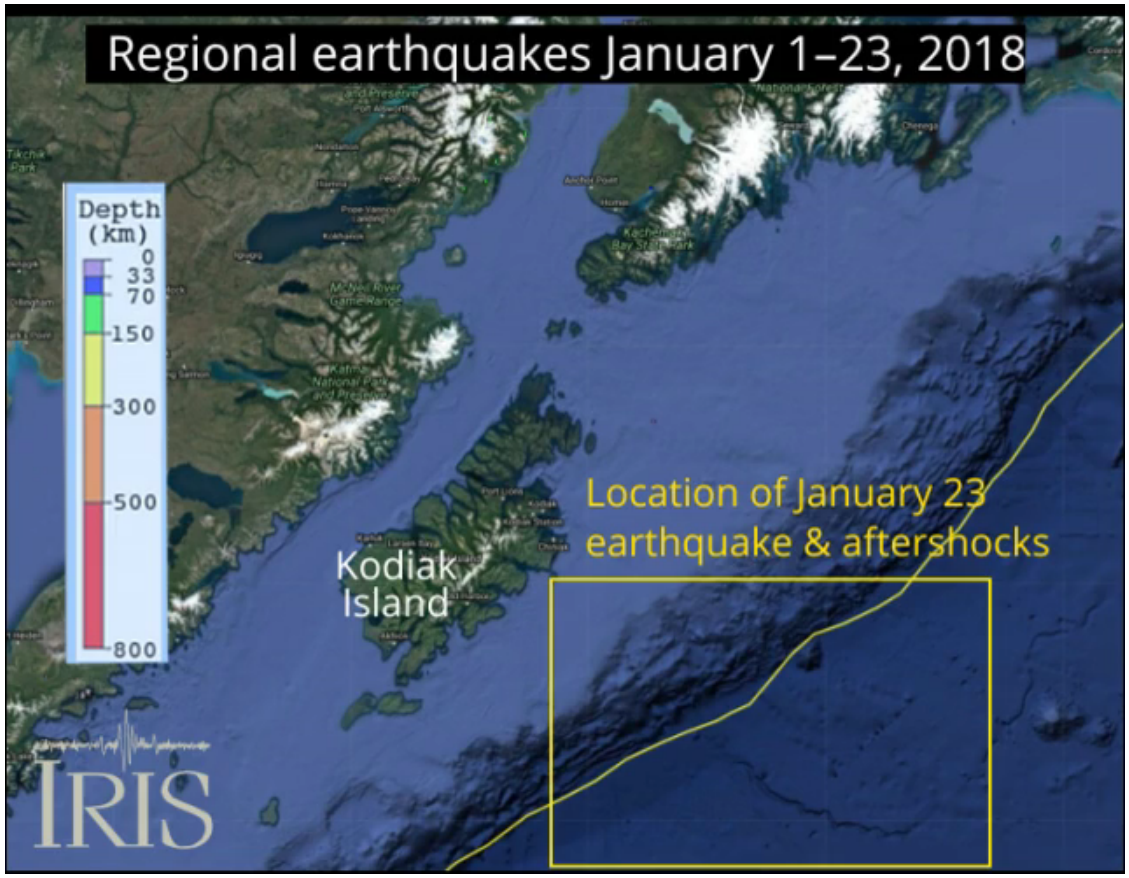
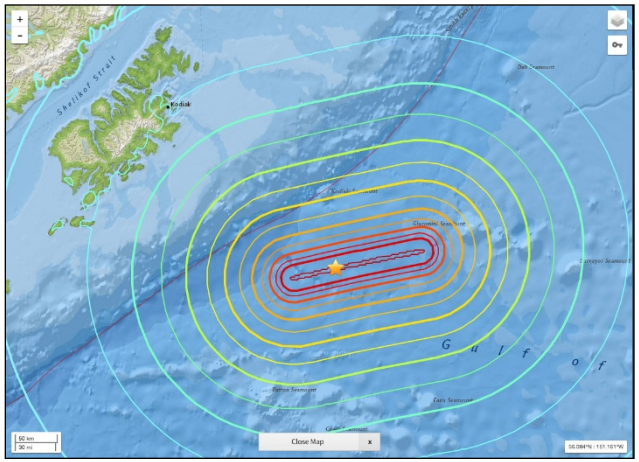
This animation from the IEB shows that there were no foreshocks in the region of this earthquake.

There have been more than 30 magnitude 4.0 – 5.0 aftershocks following this earthquake.

The aftershocks indicate the fault was oriented approximately ENE–WSW, confirmed by the USGS below.



Data from IRIS' Interactive Earthquake Browser (www.iris.edu/ieb)



LEFT: Approximate orientation of the fault from USGS National Earthquake Information Center indicates a ~NE-SW nodal plane as the fault plane.

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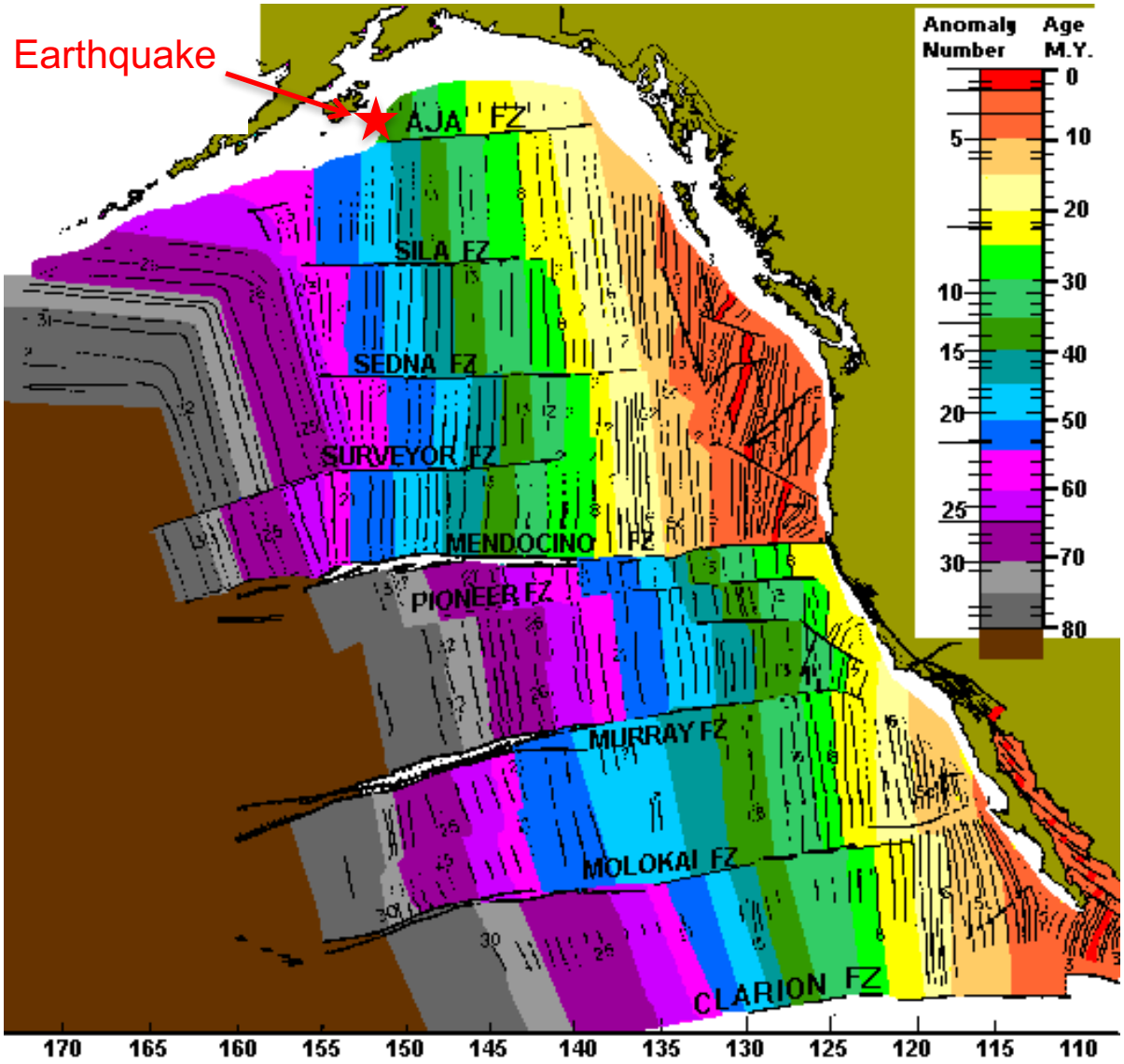
This map shows ages of oceanic crust of the Pacific Plate in the northeast Pacific Ocean, including the Gulf of Alaska.

Locations of fracture zones, like the Mendocino and Aja Fracture Zones, are labeled with the name of the feature followed by “FZ”. These fracture zones are “fossil transform faults” that were active during seafloor spreading that formed the Pacific Plate.

Most of these fracture zones are no longer active so no longer produce earthquakes. Today’s earthquake occurred north of the Aja Fracture Zone possibly on a smaller parallel fracture zone reactivated by stress within the Pacific Plate as it approaches the Aleutian Trench.



This map is based on marine geophysical research by Tanya Atwater and other researchers.

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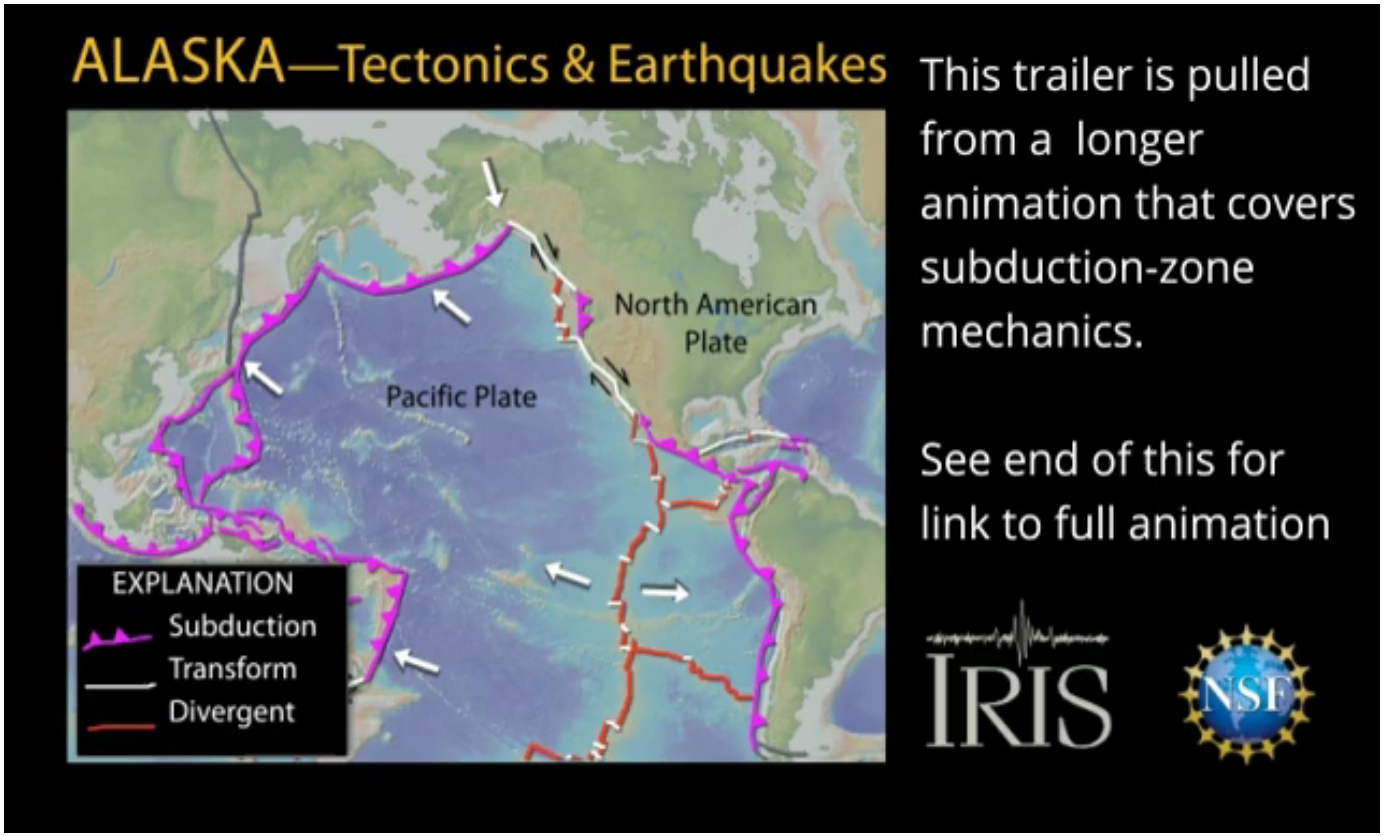
Large earthquakes are common in Alaska. Over the past 100 years, 11 M7+ earthquakes have occurred within 600 km of this earthquake. Most of these have occurred on the subduction zone interface between the two plates, northwest of this earthquake, including the M 9.2 Great Alaska earthquake in March 1964. Today's earthquake was within the Pacific Plate before it reached the subduction zone.



Animation exploring plate tectonics and earthquakes of the Pacific – North American Plate boundary region.

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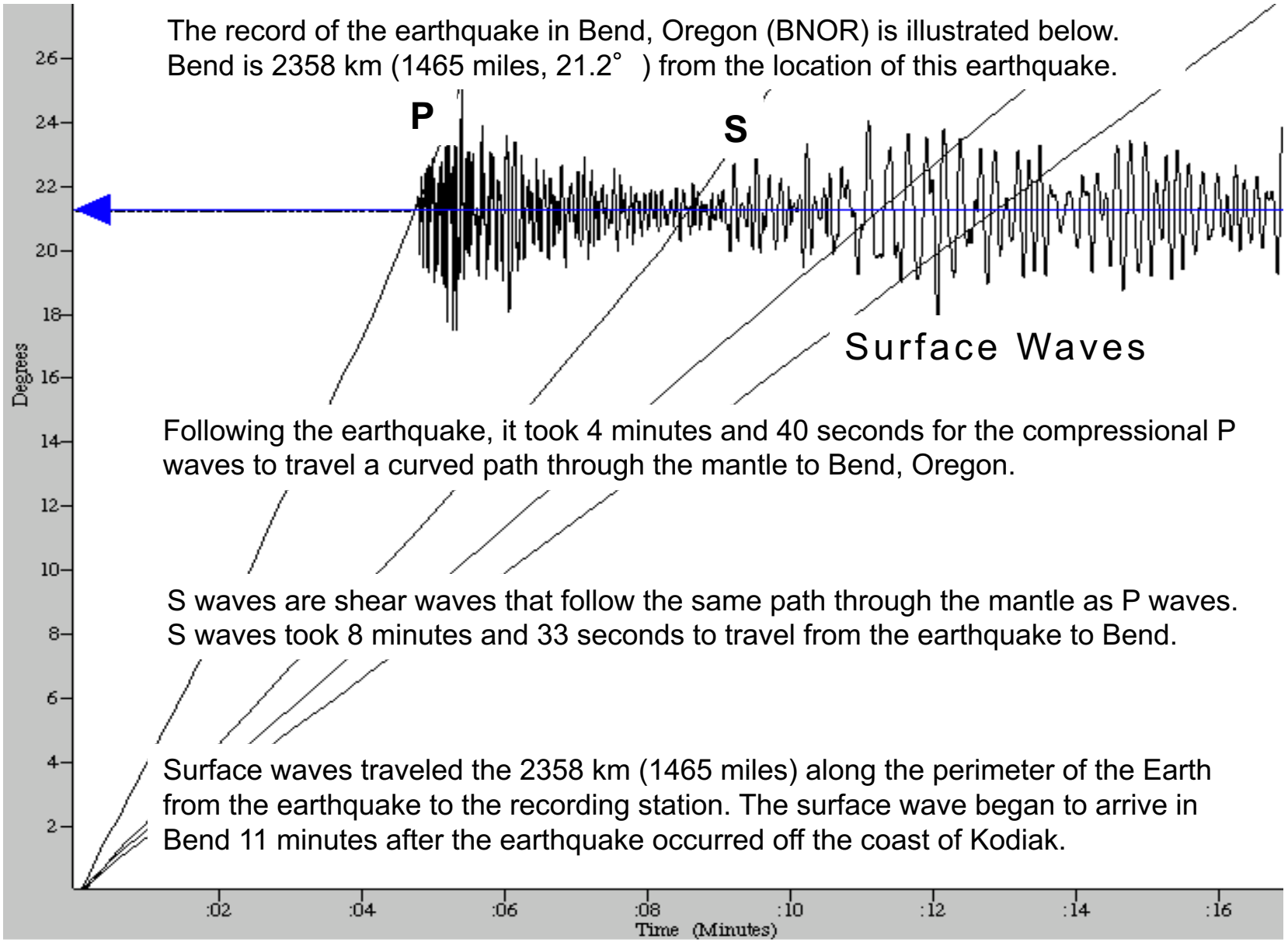
The record of the earthquake in Bend, Oregon (BNOR) is illustrated below. Bend is 2358 km (1465 miles, 21.2°) from the location of this earthquake.



Following the earthquake, it took 4 minutes and 40 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 8 minutes and 33 seconds to travel from the earthquake to Bend.

Surface waves traveled the 2358 km (1465 miles) along the perimeter of the Earth from the earthquake to the recording station. The surface wave began to arrive in Bend 11 minutes after the earthquake occurred off the coast of Kodiak.

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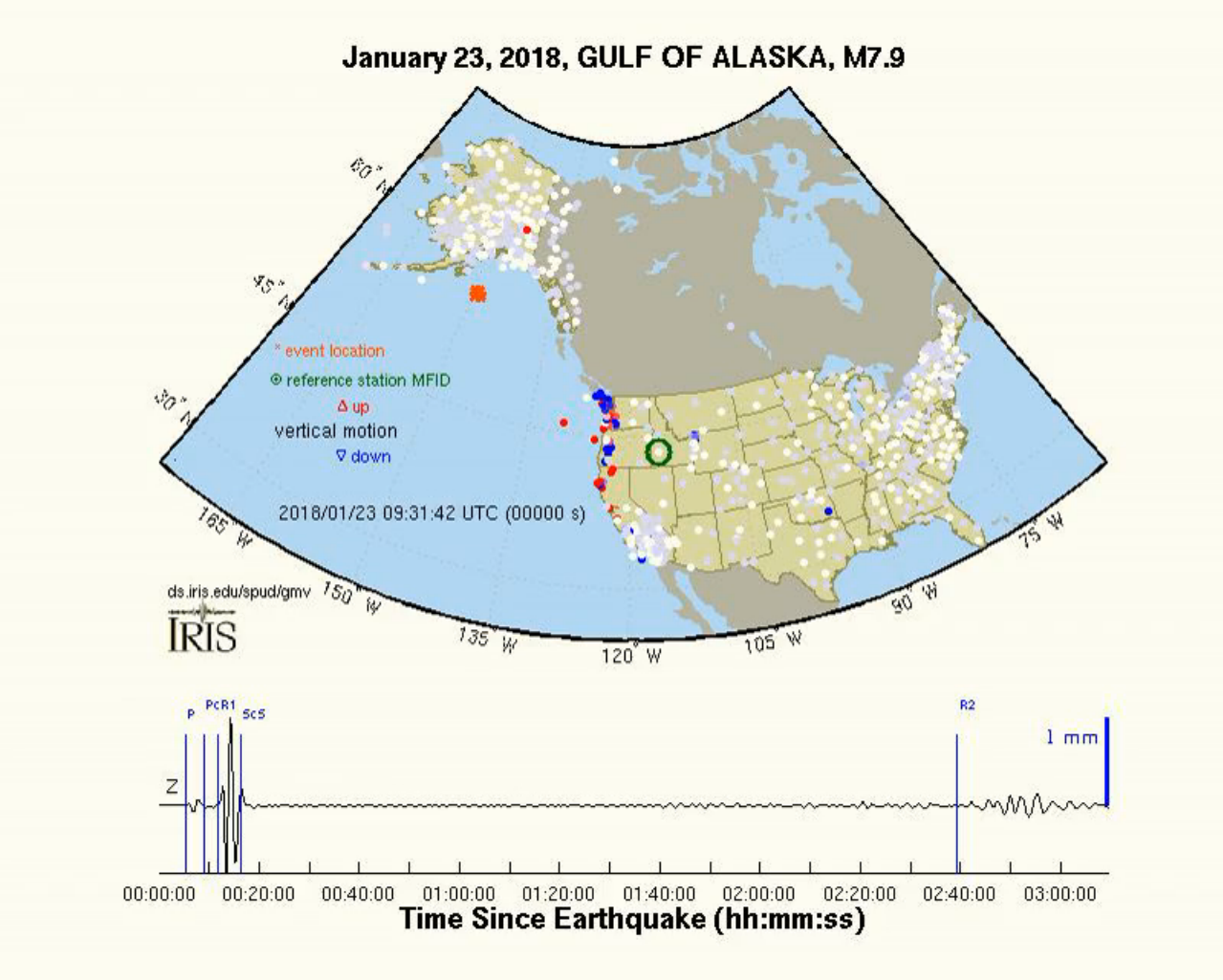
As earthquake waves travel along the surface of the Earth, they cause the ground to move. With the earthquake recording stations in EarthScope's Transportable Array, the ground motions can be captured and displayed as a movie, using the actual data recorded from the earthquake.

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.



Seismic waves crossing the US recorded by the USArray.

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