Magnitude 7.7 LOYALTY ISLANDS

Wednesday, February 10, 2021 at 13:19:55 UTC

Latitude 23.054° S
Longitude 171.601° E
Depth 10 km

A magnitude 7.7 earthquake struck just after midnight on Thursday local time about 527 km (328 miles) east of Nouméa, New Caledonia. There are no reports of damage or injuries.

The National Weather Service's US Tsunami Warning System issued a tsunami threat warning, forecasting that some hazardous waves of up to 1 m (3 feet) above tide level may reach the coasts of Fiji, New Zealand, and Vanuatu. Authorities are advising residents in coastal areas in the region to remain alert.

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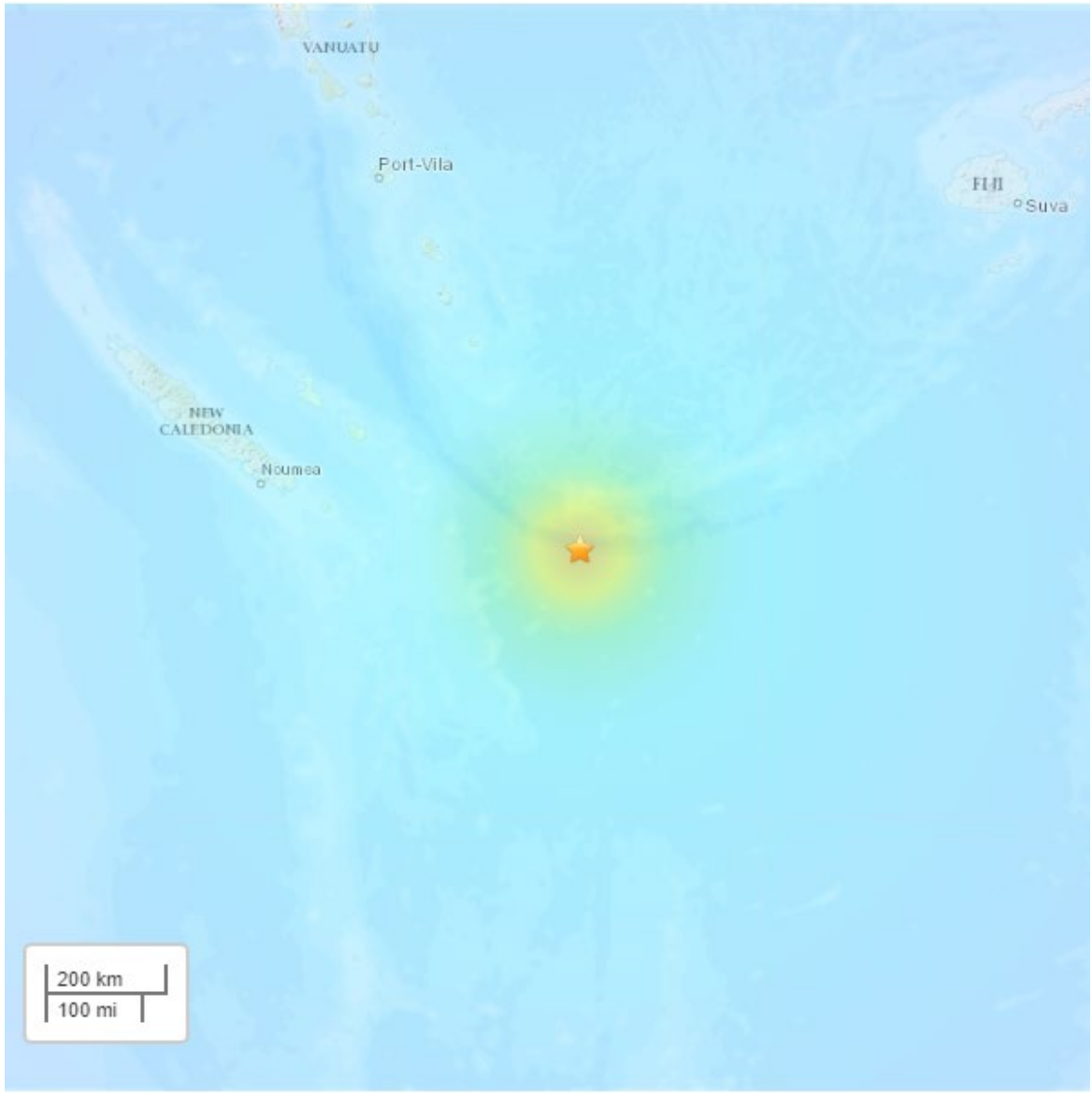
The Modified-Mercalli Intensity (MMI) scale is a ten-stage scale, from I to X, that indicates the severity of ground shaking. Intensity is based on observed effects and is variable over the area affected by an earthquake. Intensity is dependent on earthquake size, depth, distance, and local conditions.

MMI	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 7.7 Earthquake

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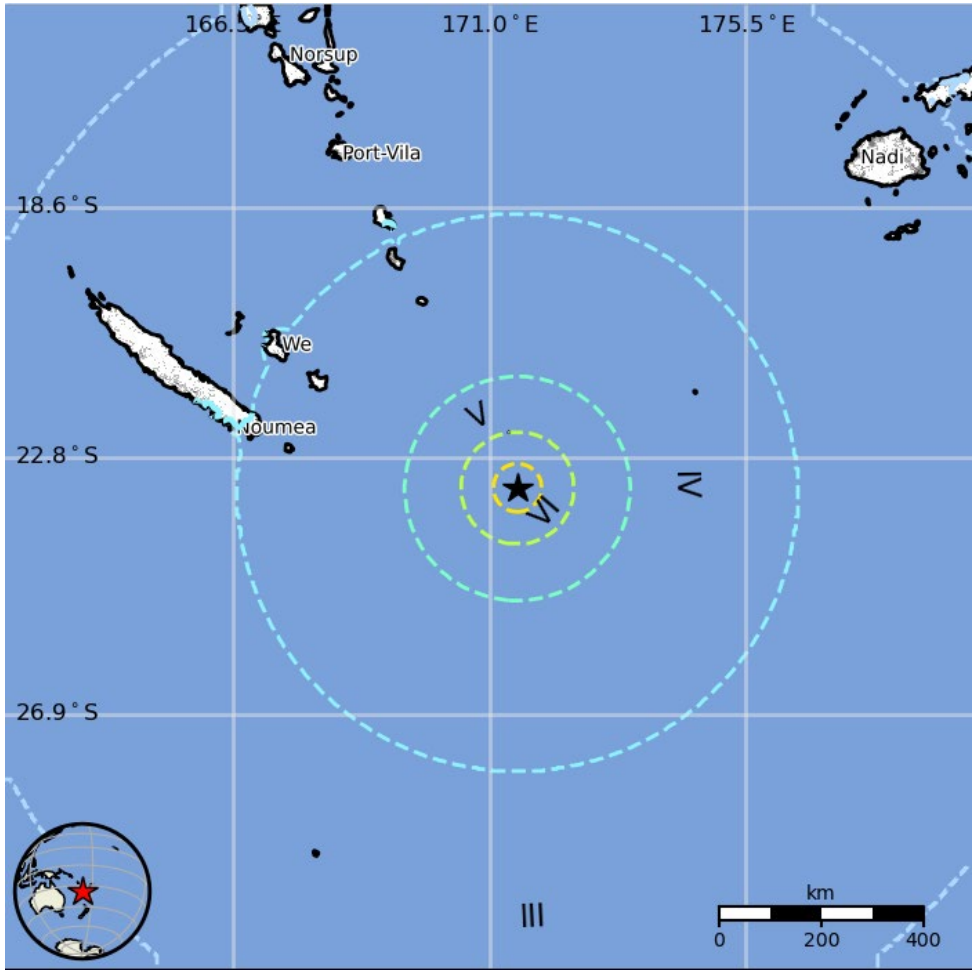
The USGS PAGER map shows the population exposed to different Modified Mercalli Intensity (MMI) levels.

The USGS estimates that 225,000 people felt light shaking from this earthquake.

I	Not Felt	0 k*
II-III	Weak	1,251 k*
IV	Light	225 k
V	Moderate	0 k
VI	Strong	0 k
VII	Very Strong	0 k
VIII	Severe	0 k
IX	Violent	0 k
X	Extreme	0 k



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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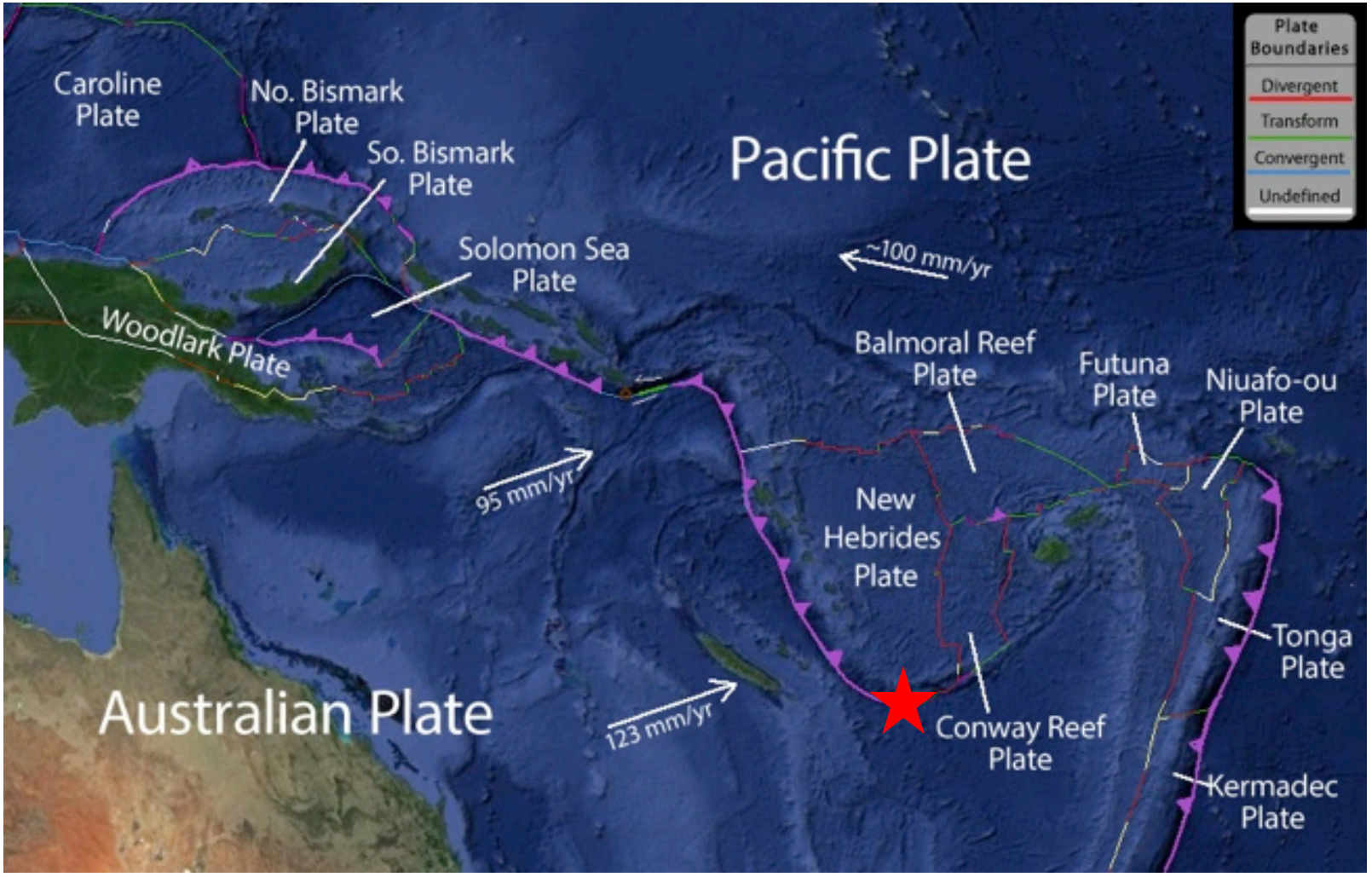
This regional map shows the complexity of plate boundaries and microplates resulting from the convergence between the Australian and Pacific Plates. The red star locates the epicenter of this magnitude 7.7 earthquake.



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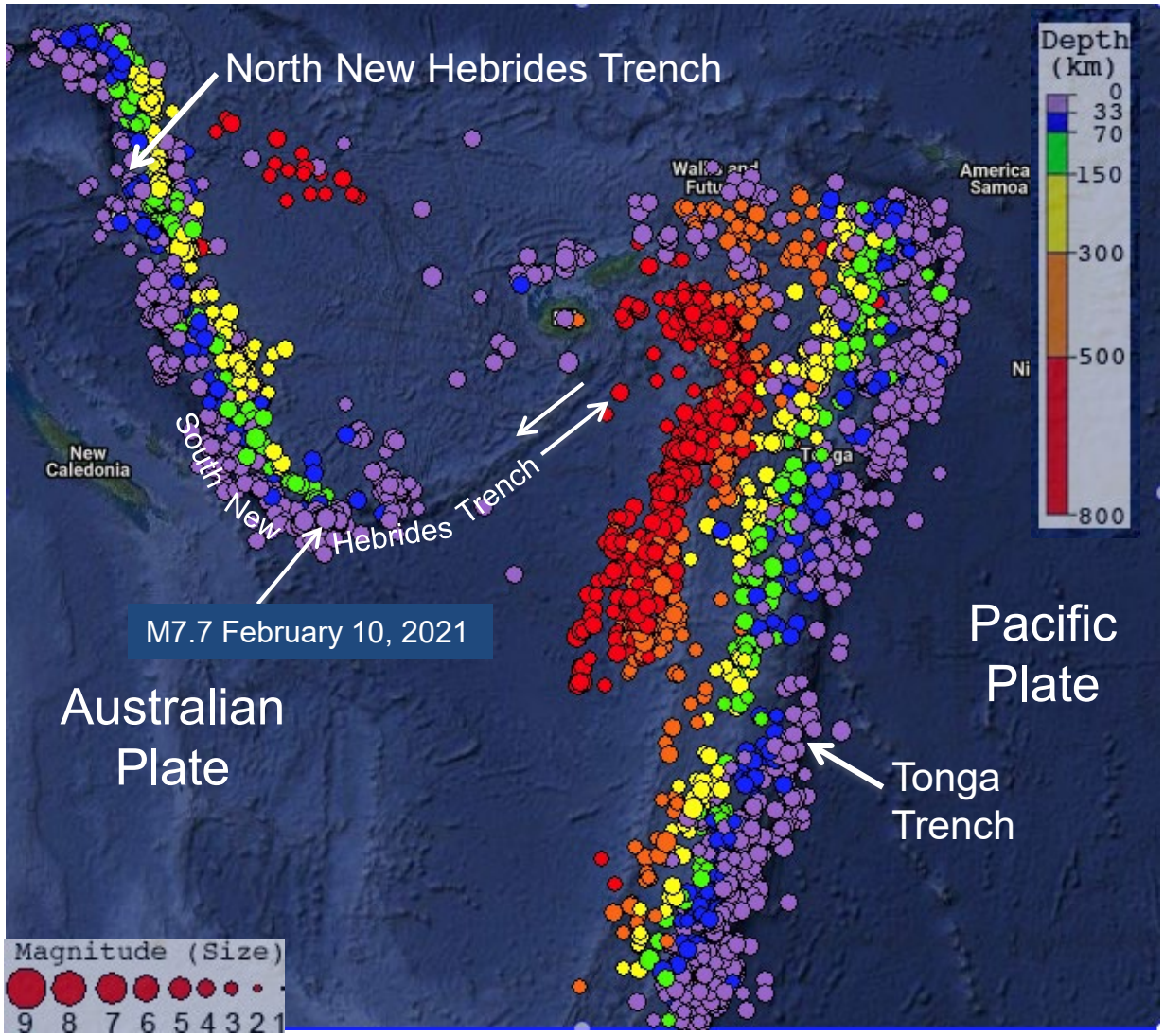
The epicenter of this M 7.7 earthquake is labeled on this seismicity map showing the most recent 3500 earthquakes in the surrounding region.

Earthquake depths increase from east to west across the Tonga Trench where the Pacific Plate subducts beneath the Australian Plate. Across the North New Hebrides Trench, earthquake depths increase from west to east where the Australia Plate subducts beneath the Pacific Plate.

This earthquake occurred along the South New Hebrides Trench, where the plate boundary transitions from subduction to left-lateral strike-slip faulting along a transform fault that connects the two subduction zones.



Map created with the IRIS Earthquake Browser

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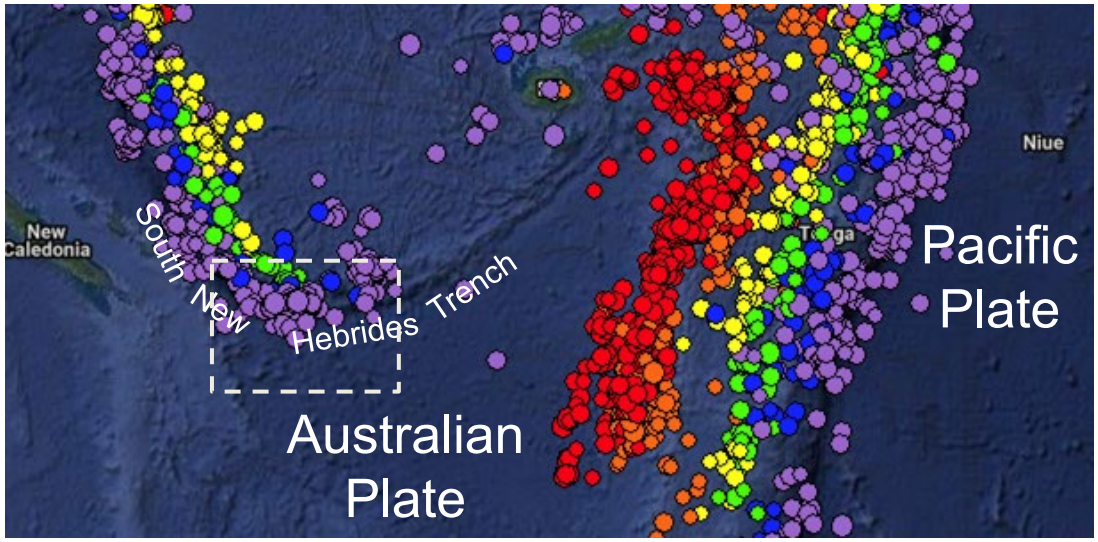
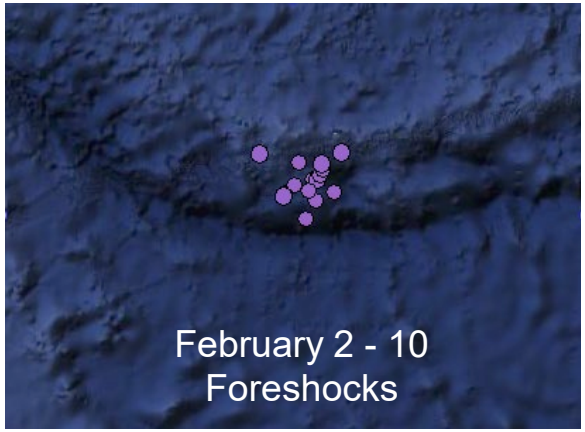
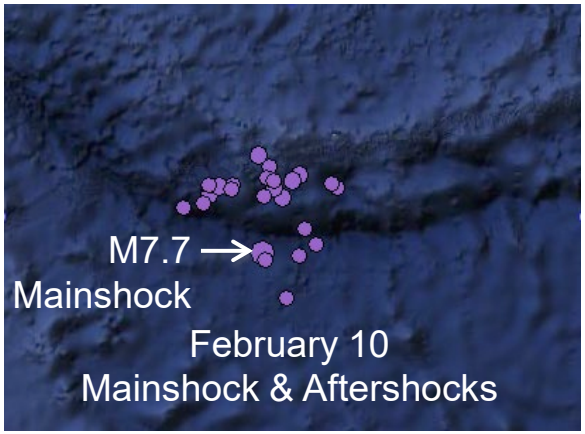
The map on the right zooms in to the Southern New Hebrides Trench region. A dashed square surrounds the location of this M 7.7 earthquake.

The map below left shows earthquakes within the dashed square that occurred from February 2nd to February 10th but just prior to the M7.7 earthquake. Those earthquakes would be considered “foreshocks” in this earthquake sequence.

The map below right shows the M 7.7 earthquake (the mainshock), and aftershocks up to 21:40 UTC on February 10th.







Maps created with the IRIS Earthquake Browser

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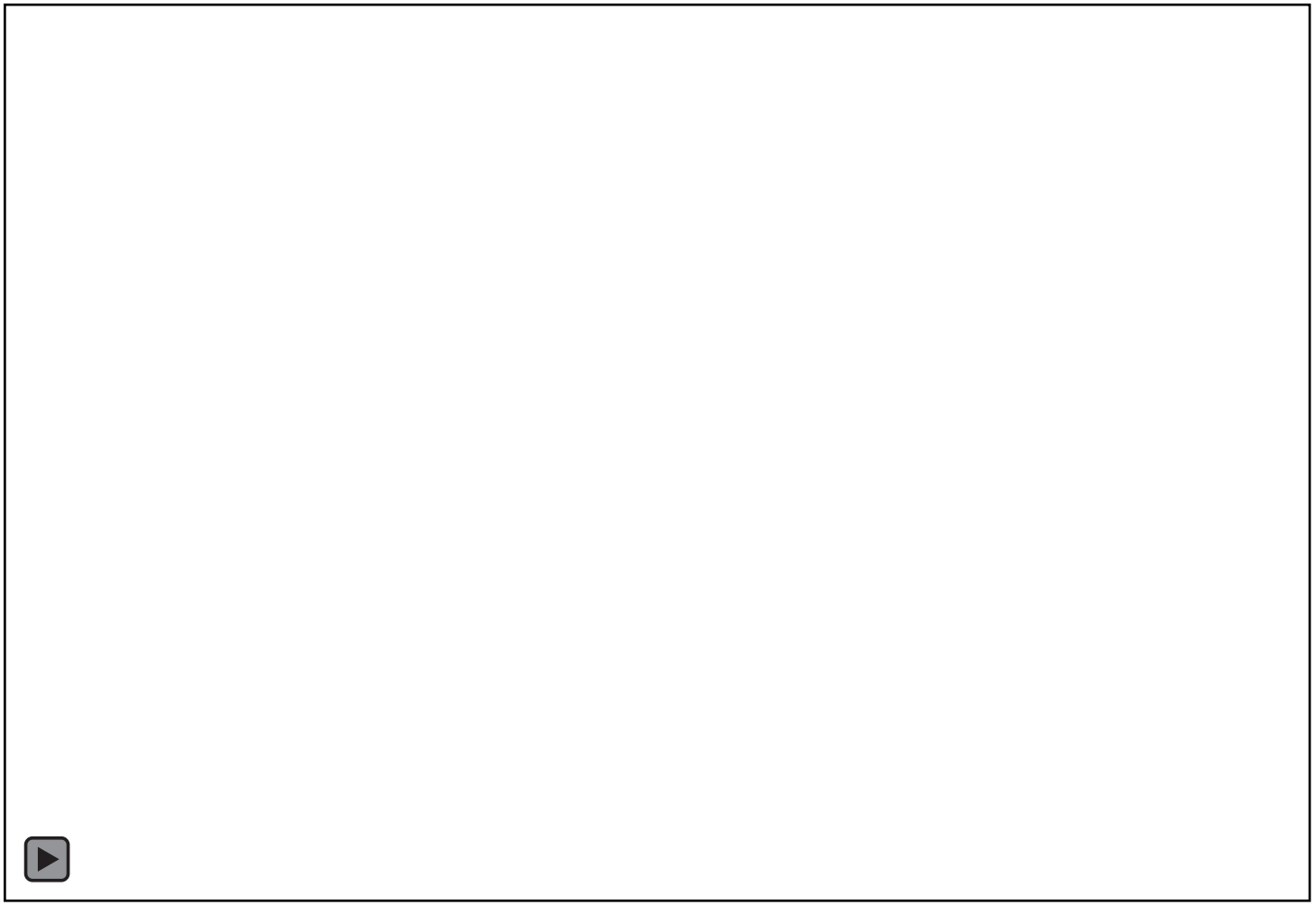
Animating the earthquakes of February 10th including foreshocks, the mainshock, and aftershocks.



Animation created with the IRIS Earthquake Browser

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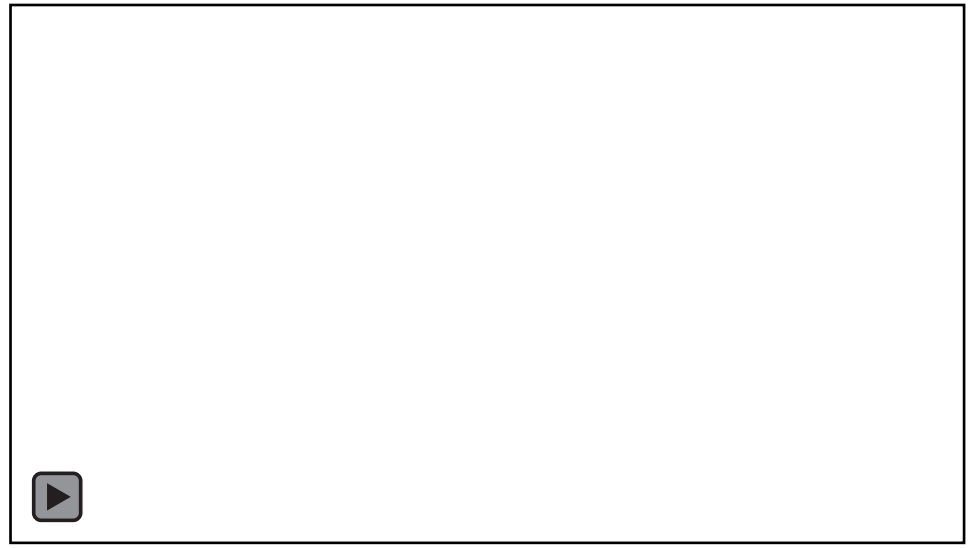
A **foreshock** is a smaller magnitude earthquake that precedes the mainshock.

There are no special characteristics of a foreshock that let us know it is a foreshock until the mainshock occurs.

A **mainshock** is largest magnitude earthquake during an earthquake sequence.

Aftershocks are smaller earthquakes occurring after a large earthquake as the fault adjusts to the new state of stress.

The graph shows how the number of aftershocks and the magnitude of aftershocks decay with increasing time since the main shock. The number of aftershocks also decreases with distance from the main shock.



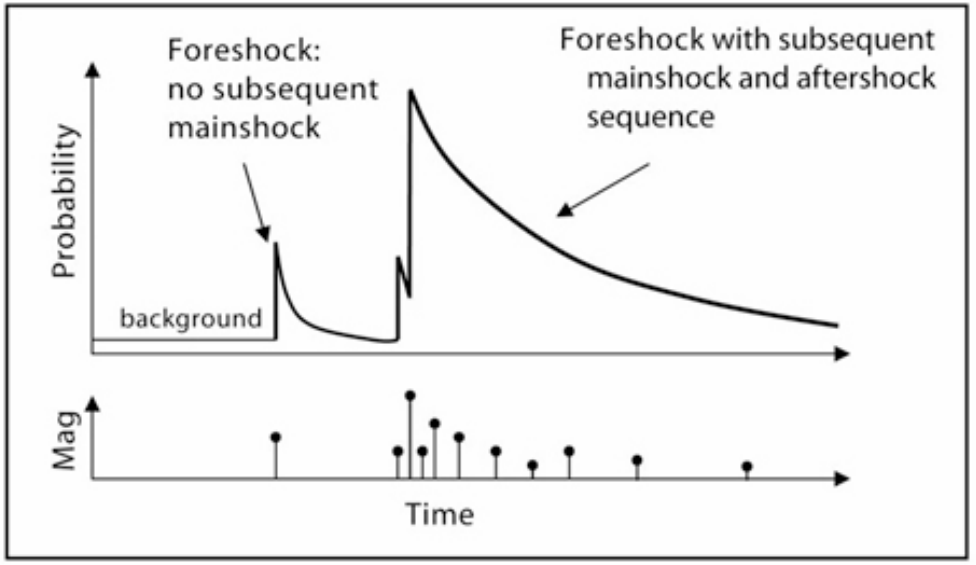


Image courtesy of the US Geological Survey

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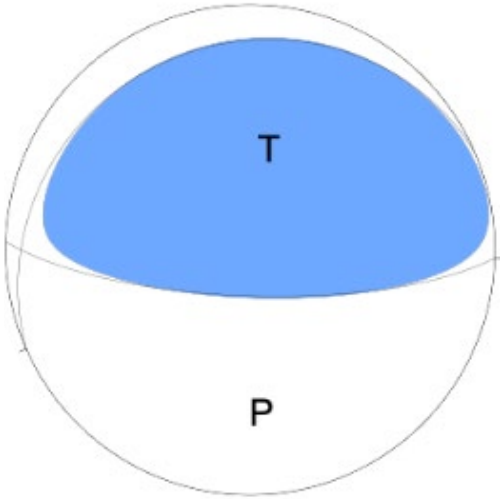
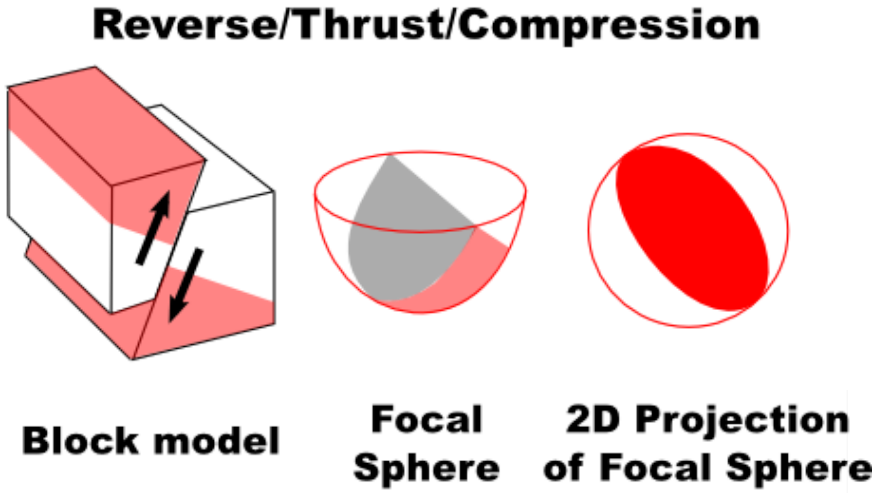
The focal mechanism is how seismologists plot the 3-D stress orientations of an earthquake. Because an earthquake occurs as slip on a fault, it generates primary (P) waves in quadrants where the first pulse is compressional (shaded) and quadrants where the first pulse is extensional (white). The orientation 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 was due to thrust faulting or near on the plate boundary between the subducting Australia Plate and the overriding Pacific Plate.



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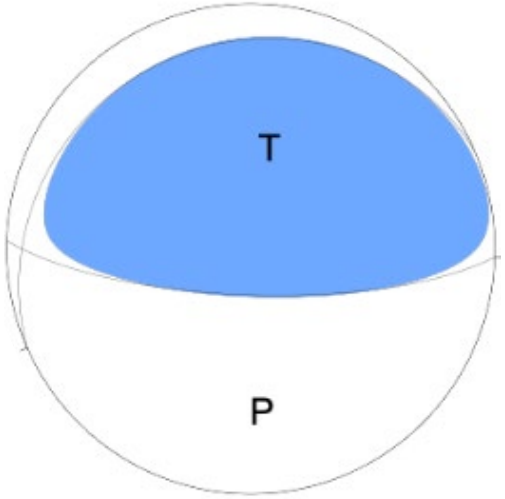
This animation explores the motion of a reverse fault, and how reverse faults are represented in a focal mechanism.

Remember, this was the focal mechanism solution for this earthquake. It was estimated by an analysis of observed seismic waveforms, recorded after the earthquake, observing the pattern of "first motions", that is, whether the first arriving P waves push up or down.



USGS W-phase Moment Tensor Solution

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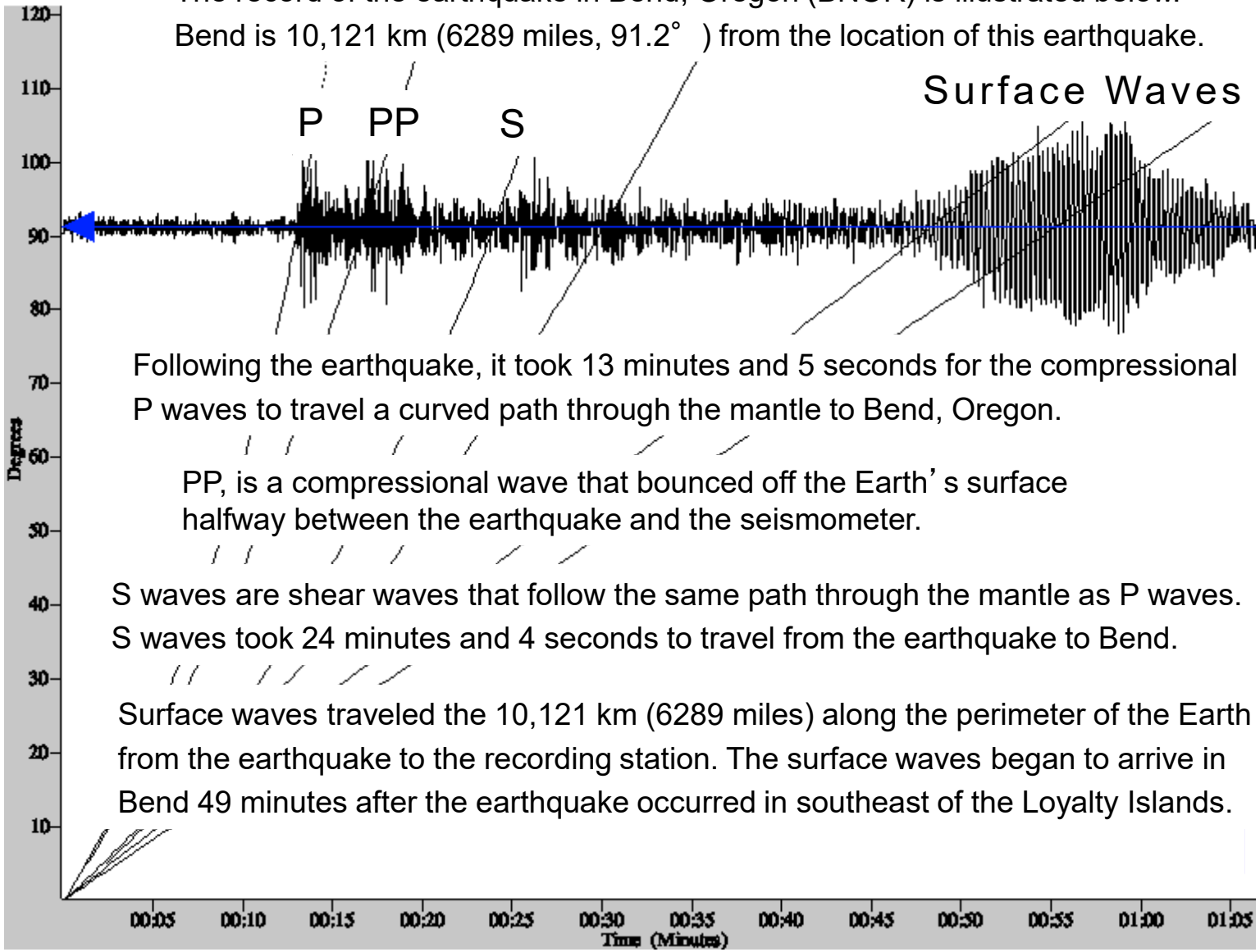
The record of the earthquake in Bend, Oregon (BNOR) is illustrated below.
Bend is 10,121 km (6289 miles, 91.2°) from the location of this earthquake.



Following the earthquake, it took 13 minutes and 5 seconds for the compressional P waves to travel a curved path through the mantle to Bend, Oregon.

PP, is a compressional wave that bounced off the Earth's surface halfway between the earthquake and the seismometer.

S waves are shear waves that follow the same path through the mantle as P waves. S waves took 24 minutes and 4 seconds to travel from the earthquake to Bend.

Surface waves traveled the 10,121 km (6289 miles) along the perimeter of the Earth from the earthquake to the recording station. The surface waves began to arrive in Bend 49 minutes after the earthquake occurred in southeast of the Loyalty Islands.

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