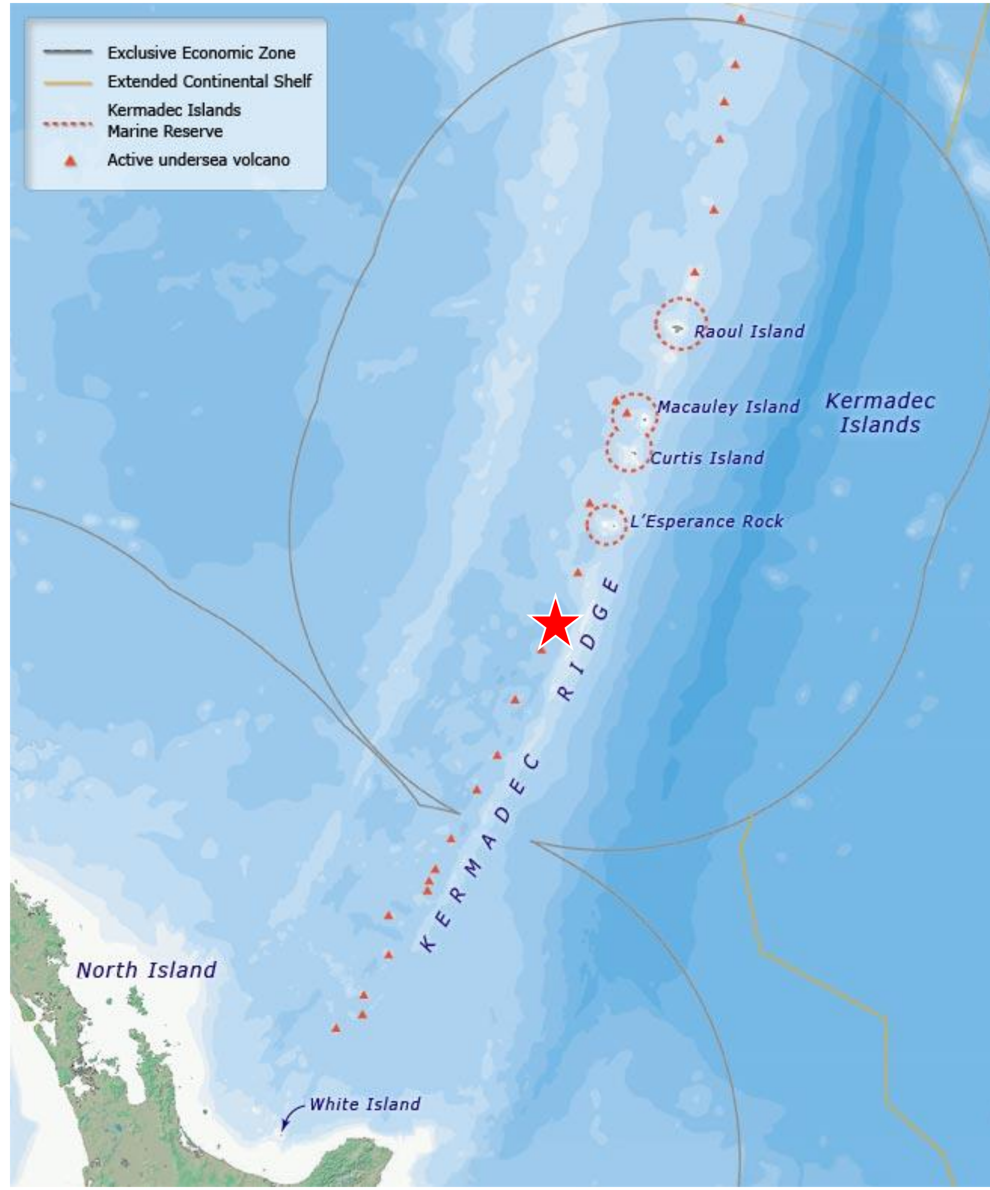
Magnitude 7.2 KERMADEC ISLANDS, NEW ZEALAND

Saturday, June 15, 2019 at 22:55:02 UTC

A magnitude 7.2 earthquake occurred in the Kermadec Islands, about 800 km northeast of New Zealand's North Island at a depth of 34.4 km.

The Kermadec Islands are the tiny emergent part of a chain of submarine volcanoes that define the Kermadec Ridge. There are no permanent settlements on the islands.



In political terms, the Kermadecs are important for New Zealand as they define the northern extent of the Exclusive Economic Zone (EEZ) and the Extended Continental Shelf (ECS).

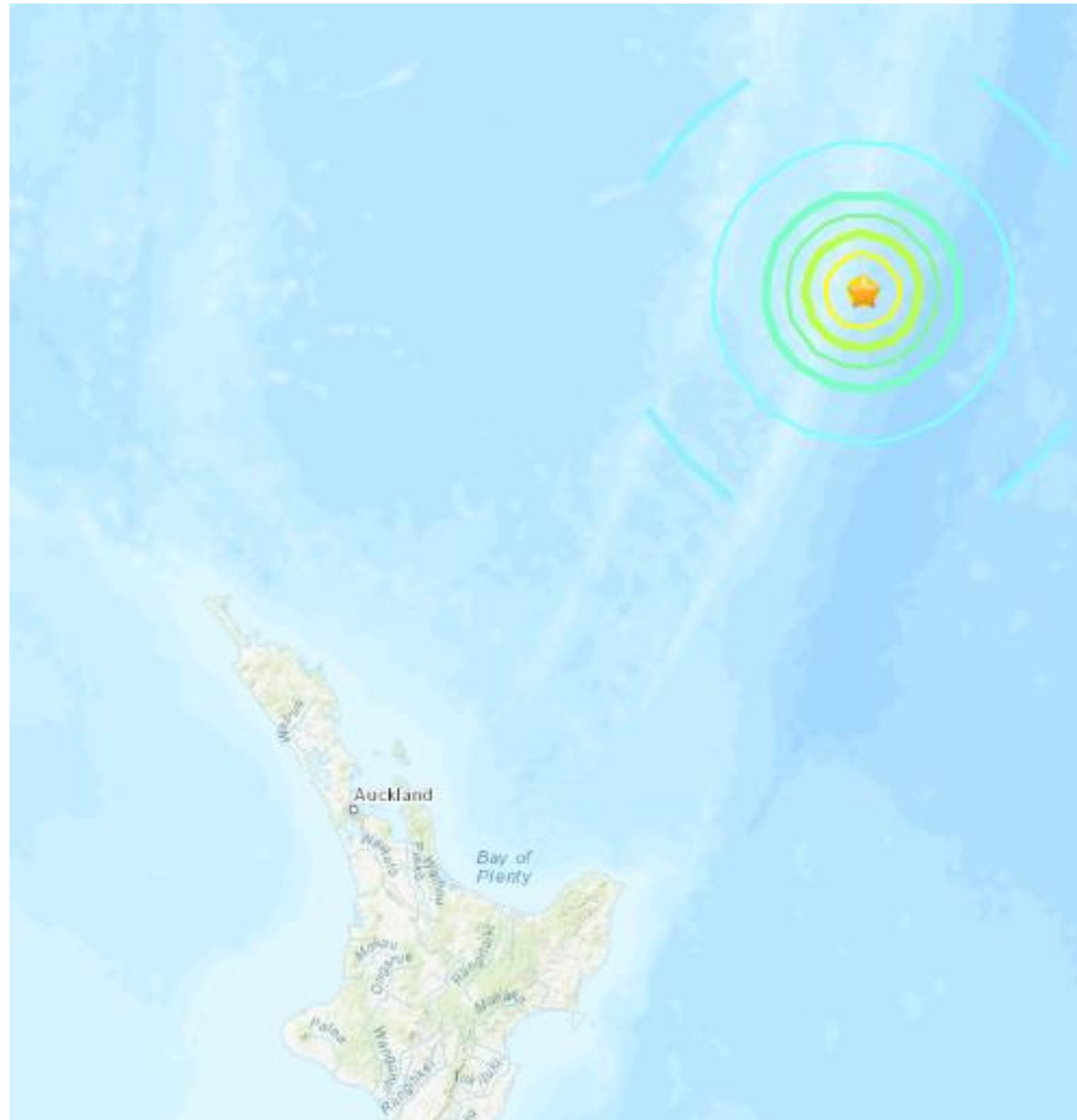
Image courtesy: Simon Nathan, 'Kermadec Islands - Geology and climate', Te Ara - the Encyclopedia of New Zealand

Magnitude 7.2 KERMADEC ISLANDS, NEW ZEALAND
Saturday, June 15, 2019 at 22:55:02 UTC

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

The uninhabited Kermadec Islands were the only land to feel this earthquake.

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 7.2 Earthquake

Magnitude 7.2 KERMADEC ISLANDS, NEW ZEALAND
Saturday, June 15, 2019 at 22:55:02 UTC

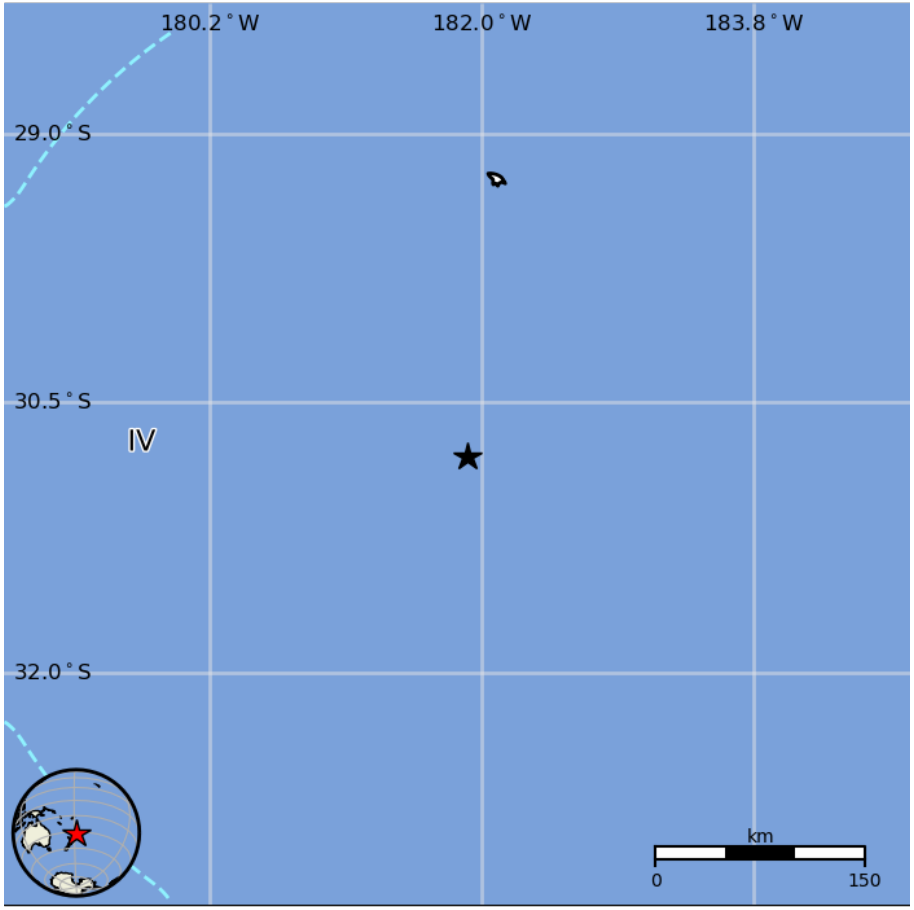
The USGS PAGER map shows the population exposed to different Modified Mercalli Intensity (MMI) levels.

No one felt this earthquake.

I	Not Felt	0 k*
II-III	Weak	0 k*
IV	Light	0 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

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.

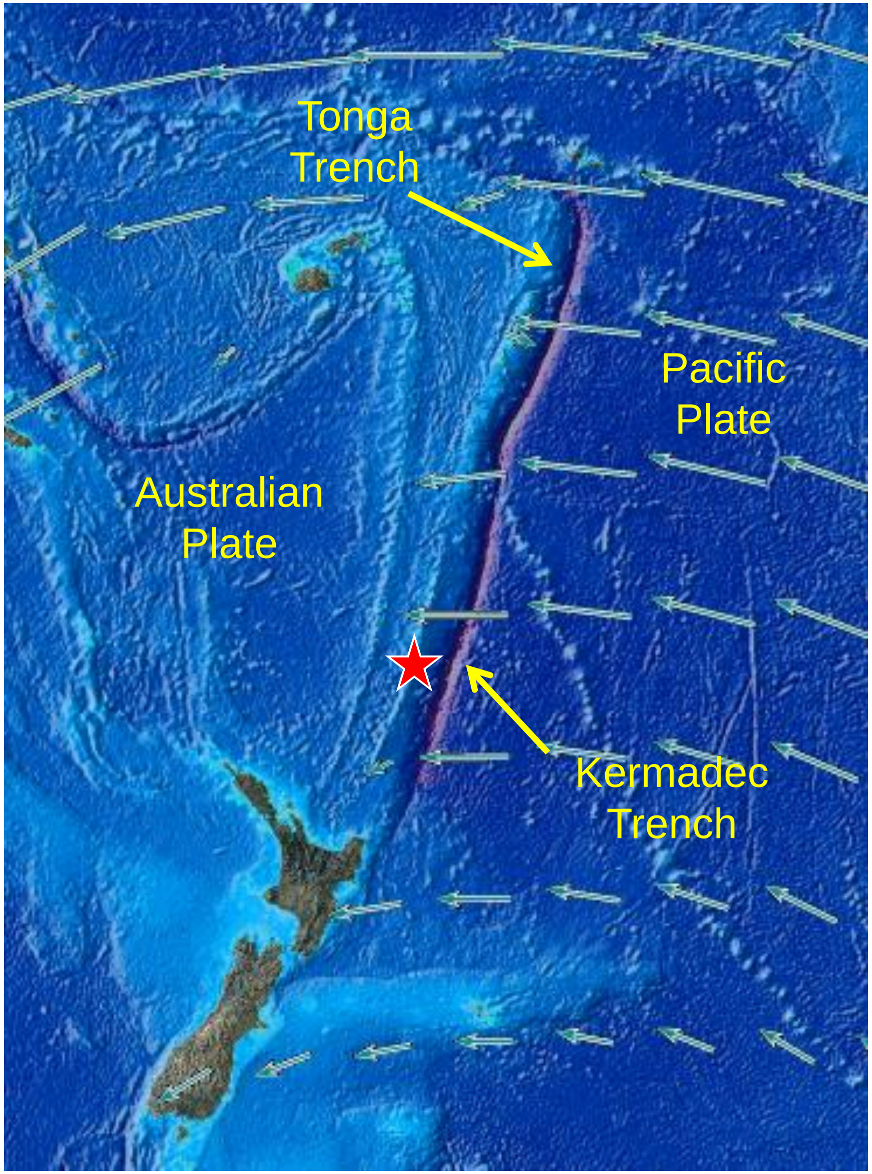
Image courtesy of the US Geological Survey

Magnitude 7.2 KERMADEC ISLANDS, NEW ZEALAND
Saturday, June 15, 2019 at 22:55:02 UTC

The blue arrows show the motion of the Pacific Plate with respect to the Australian Plate. The epicenter of the June 15, 2019 earthquake is shown by the red star.

The location, depth, and focal mechanism indicate that this earthquake occurred on the subduction zone boundary where the Pacific Plate subducts beneath the Australian Plate at this ocean – ocean convergent plate boundary.

The rate of convergence at the location of Saturday's earthquake is about 60 mm/yr (6.0 cm/yr). Notice that the rate and direction of motion of the Pacific Plate change with distance north from New Zealand. These changes remind us that lithospheric plate motions are actually relative <u>rotations</u> of spherical shells along Earth's surface rather than linear motions of flat plates.

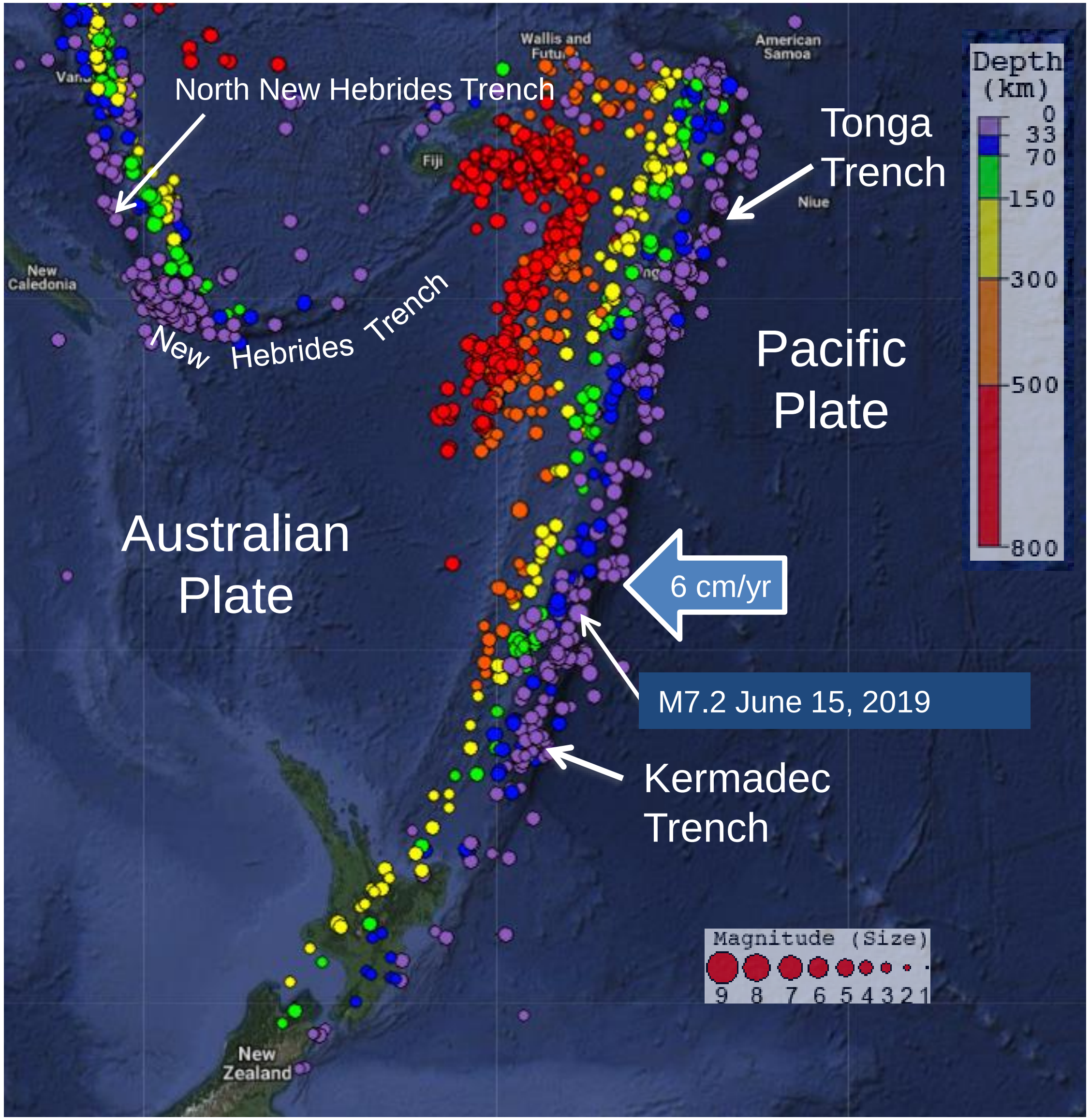


Magnitude 7.2 KERMADEC ISLANDS, NEW ZEALAND
Saturday, June 15, 2019 at 22:55:02 UTC

This earthquake is labeled on this seismicity map showing the most recent 2000 magnitude 4 or larger earthquakes in this region of convergence between the Australian and Pacific Plates.

Across the Kermadec and Tonga trenches, earthquake depths increase from east to west as the Pacific Plate subducts beneath the Australian Plate.

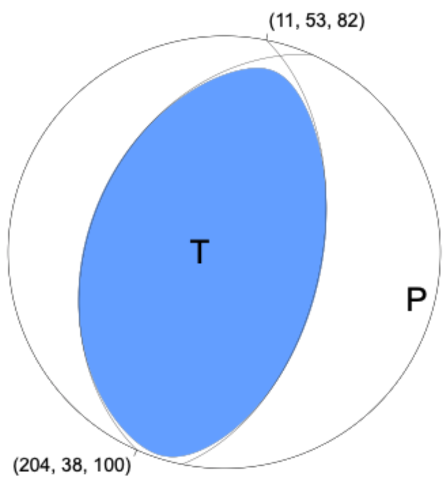
Notice that the depths of the deepest earthquakes increase from south to north along the Kermadec and Tonga trenches. The Pacific Plate subducts faster into the Tonga Trench than into the Kermadec Trench so it remains brittle and capable of generating deeper earthquakes in the northern part of the subduction zone.



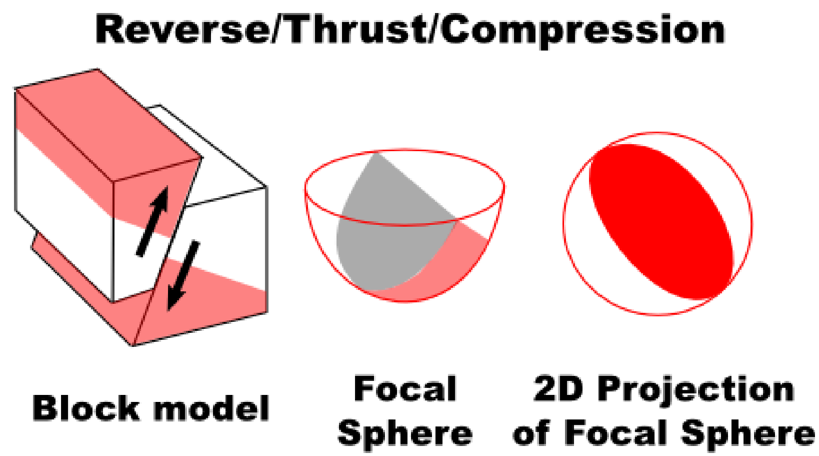
Map created with the IRIS Earthquake Browser

Magnitude 7.2 KERMADEC ISLANDS, NEW ZEALAND
Saturday, June 15, 2019 at 22:55:02 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.

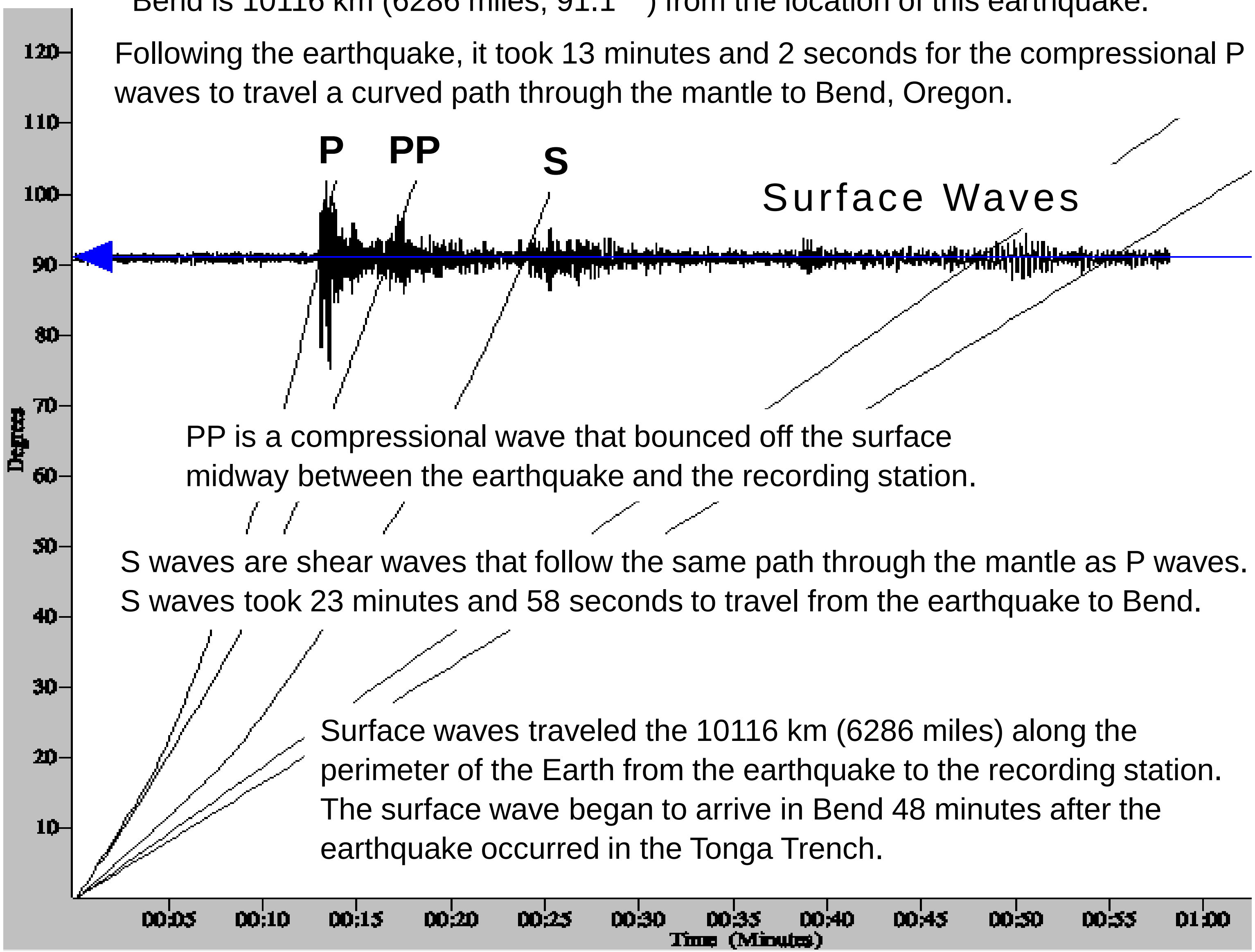
In this case, the focal mechanism indicates this earthquake occurred as the result of thrust faulting between the overriding Australian and subducting Pacific Plates.

IRIS
Teachable Moments

Magnitude 7.2 KERMADEC ISLANDS, NEW ZEALAND

Saturday, June 15, 2019 at 22:55:02 UTC

The record of the earthquake in Bend, Oregon (BNOR) is illustrated below. Bend is 10116 km (6286 miles, 91.1°) from the location of this earthquake.



Following the earthquake, it took 13 minutes and 2 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 surface midway between the earthquake and the recording station.

S waves are shear waves that follow the same path through the mantle as P waves. S waves took 23 minutes and 58 seconds to travel from the earthquake to Bend.

Surface waves traveled the 10116 km (6286 miles) along the perimeter of the Earth from the earthquake to the recording station. The surface wave began to arrive in Bend 48 minutes after the earthquake occurred in the Tonga Trench.

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