Magnitude 7.1 PERU
Friday, August 24, 2018 at 09:04:06 UTC

A magnitude 7.1 earthquake struck Peru's border with Brazil 38km (23.6 mi) WNW of Iberia, Peru and 223.8 km (139.0 mi) W of Cobija, Bolivia at a depth of 609.5 km (378.7 miles). There are no initial reports of casualties or damage.

Plaza de Armas in Iberia, Peru

Parque Nacional Alto Purus, Peru (90km (56 miles) W of earthquake)

Images courtesy Google

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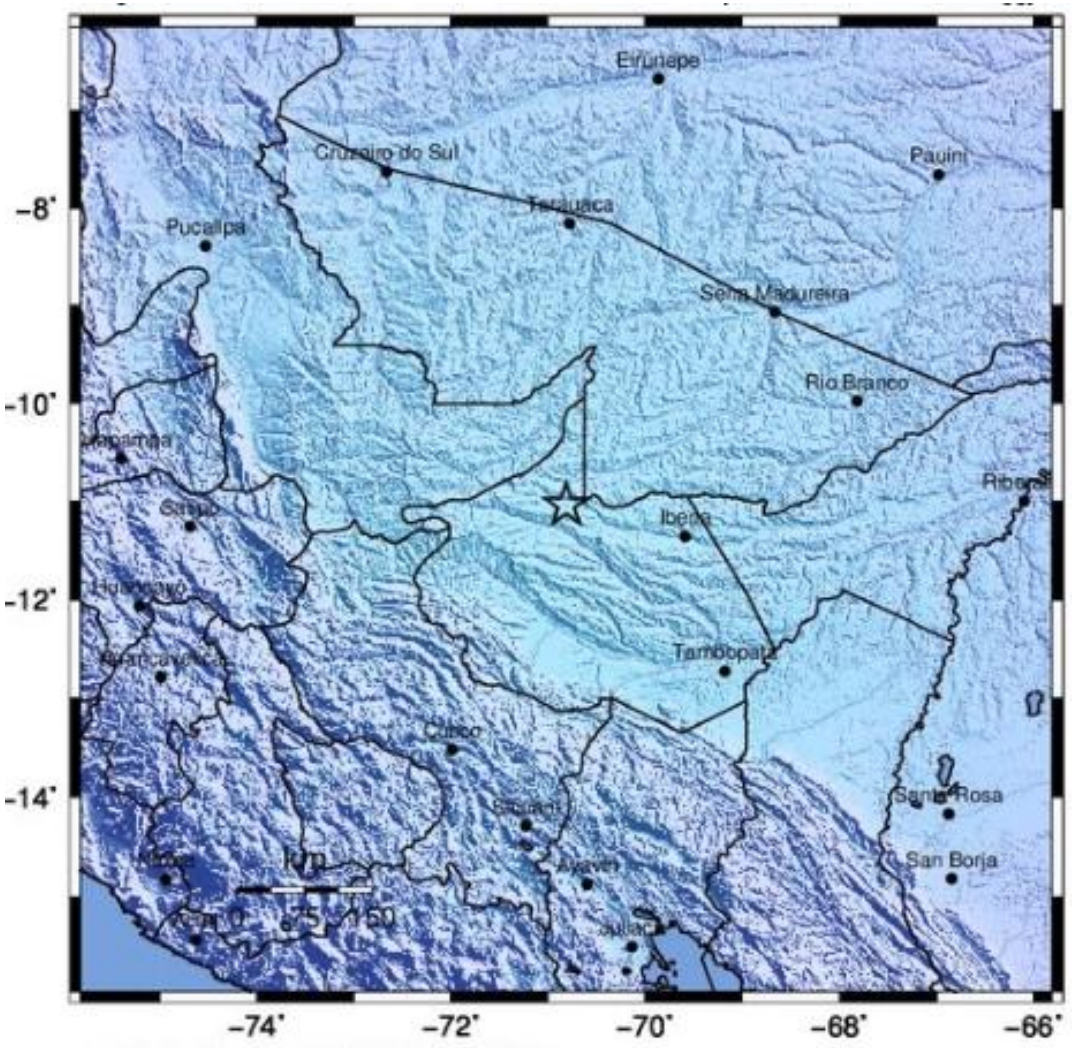
The Modified-Mercalli Intensity scale is a twelve-stage scale, from I to XII, that indicates the severity of ground shaking.

Due to the depth of 609.5 km (378.7 miles), the area nearest the earthquake experienced only weak shaking.

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

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USGS PAGER
Population Exposed to Earthquake Shaking

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

The USGS estimates that over 8.5 million people felt weak shaking from this earthquake.

MMI	Shaking	Pop.
I	Not Felt	0 k*
II-III	Weak	8,572 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

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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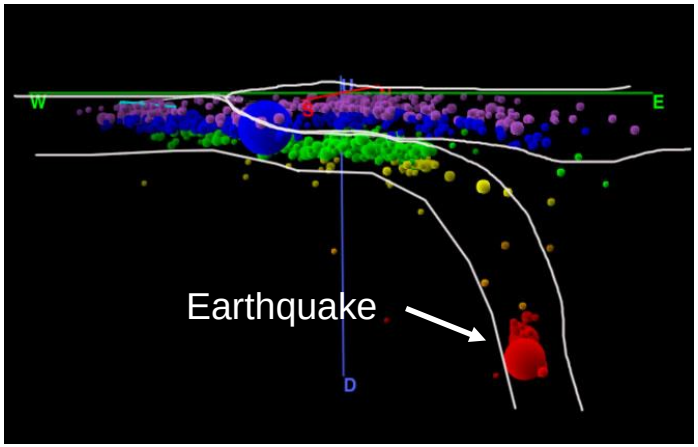
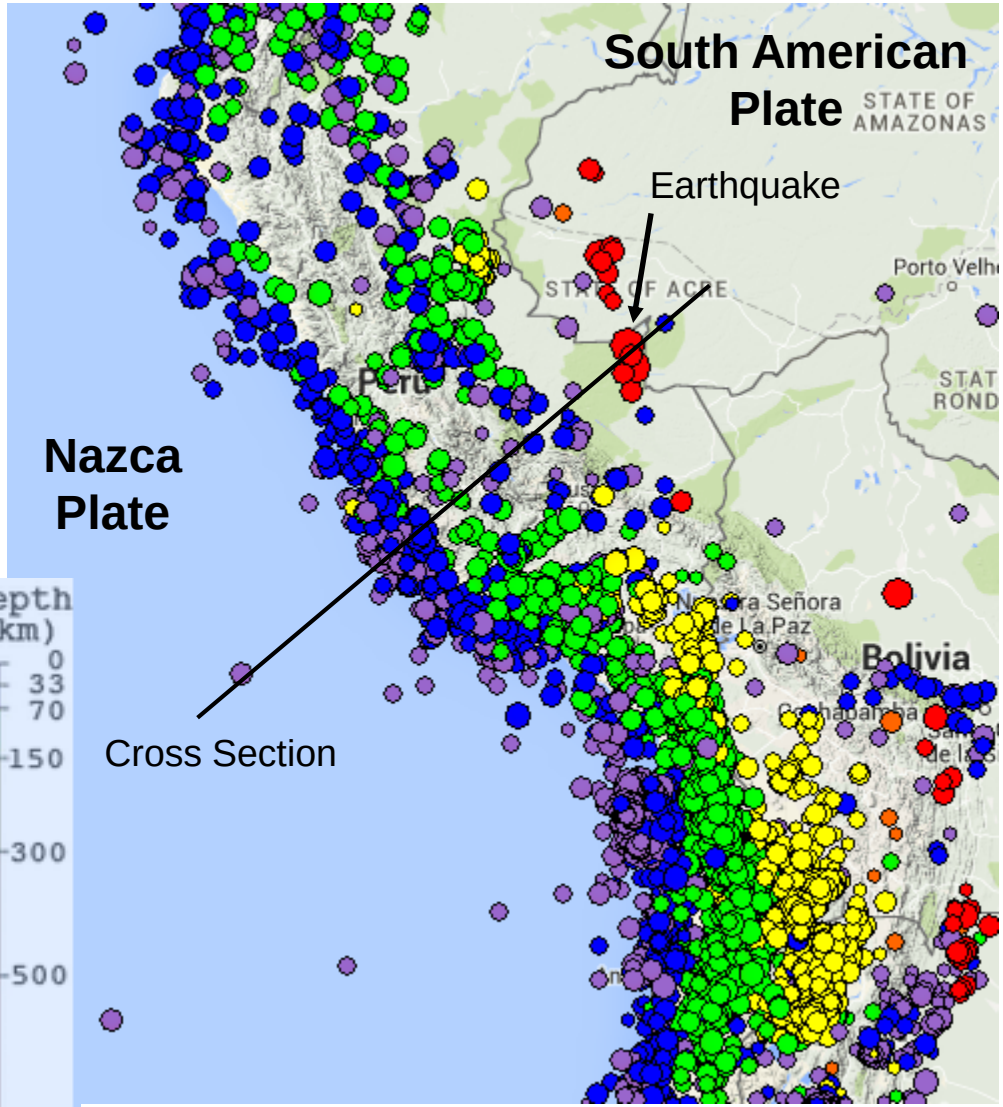
Epicenters are shown on a map of regional historic seismicity on the right, a 3D view is shown below. Earthquakes are shallow near west side of the map area. As the Nazca Plate subducts to the east beneath the South American Plate, earthquakes within the Nazca Plate increase in depth from west to east.





Map generated using IRIS Earthquake Browser

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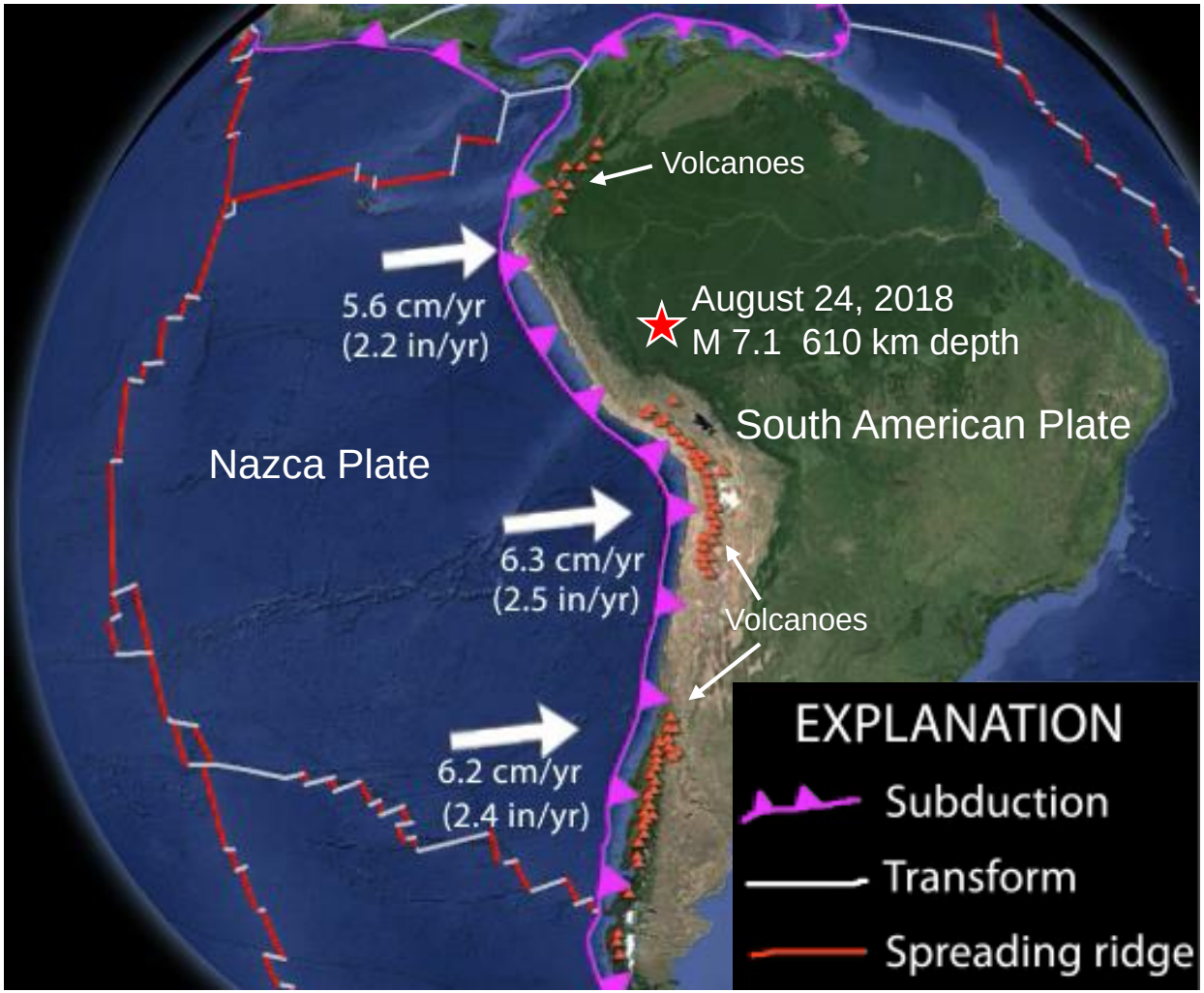
This illustration shows the rate and direction of motion of the Nazca Plate with respect to the South American Plate. Locations of active Andean volcanoes are shown by the orange triangles.

The epicenter of the August 24 earthquake is shown by the red star. At the location of this earthquake, the Nazca Plate subducts beneath the South America Plate at a velocity of about 58 mm/yr.



In most of Peru and on the Chile/Argentina border at about 30° S, there are no active volcanoes. These are areas of “flat slab” subduction that is explained in the following slide. The August 24 earthquake is within the northern region of “flat slab” subduction.

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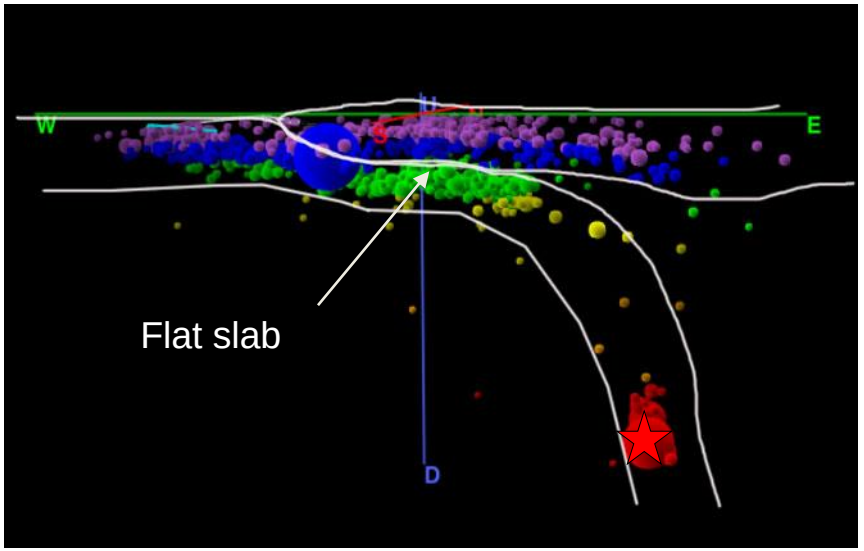
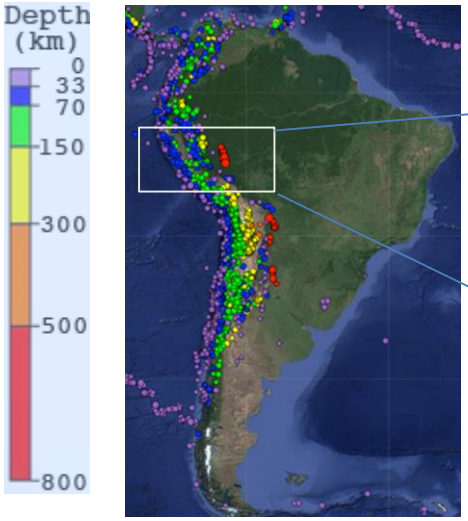
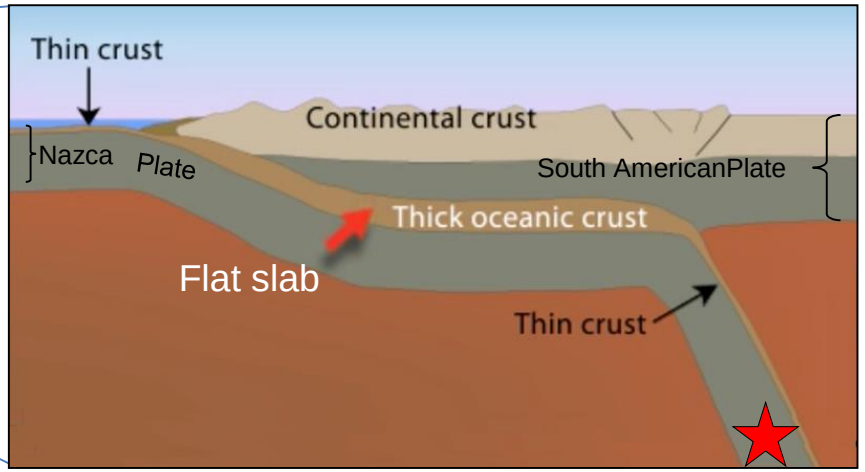
In most of Peru, earthquakes reveal what is called “flat-slab” subduction. In these segments, the oceanic plate dives to 100 km depth then slides along the bottom of the South American Plate for several hundred kilometers before resuming its descent into Earth’s mantle. The focus of the August 24 earthquake deep within the subducting Nazca Plate is shown by the red star.



Above: 3-D view from the IRIS Earthquake Browser (IEB) with rough sketch of interpreted plate outlines.
Below: Graphic representation of cross section of this region of the flat-slab subduction of the Nazca Plate





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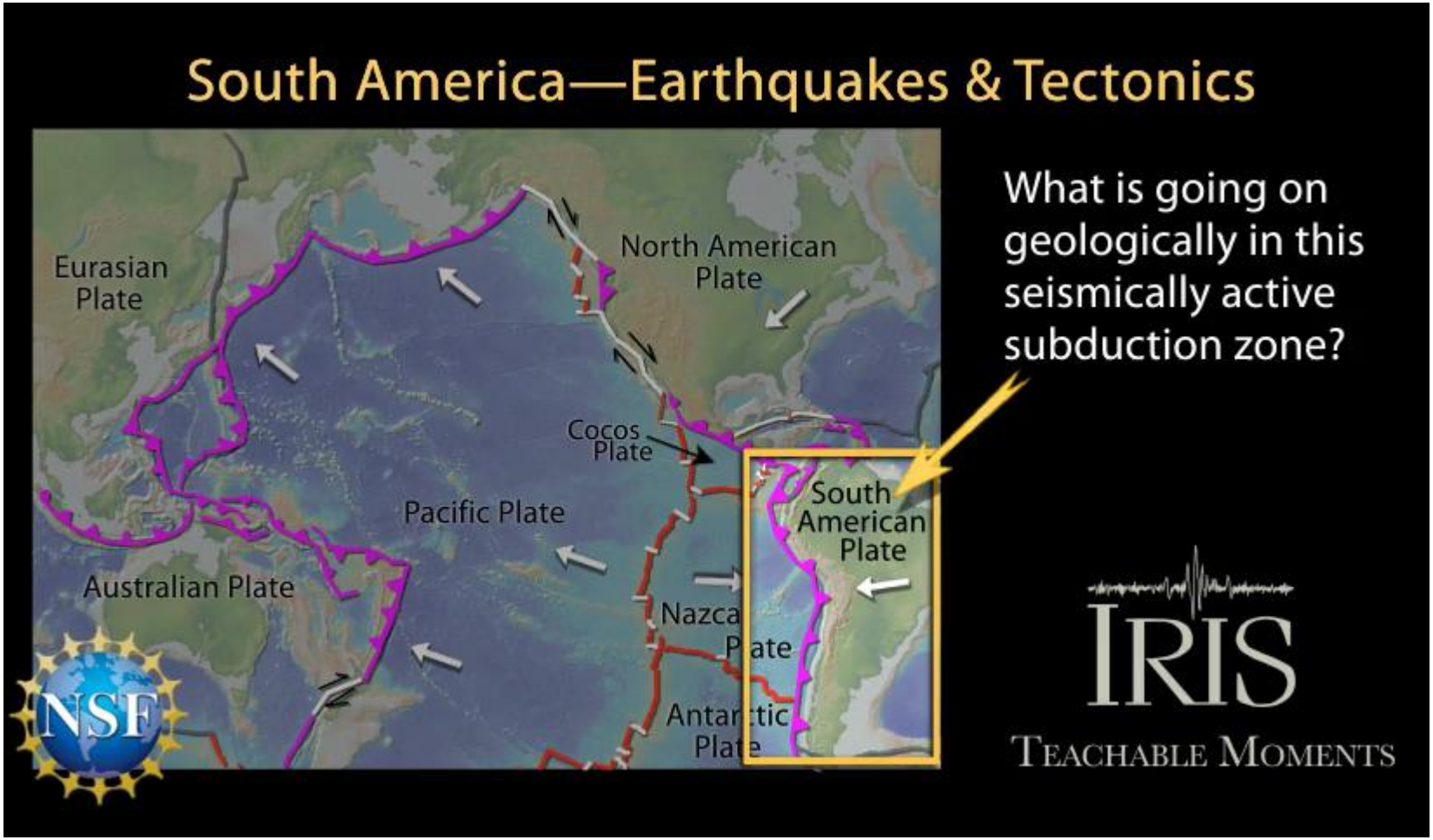
Animation exploring plate tectonics and earthquakes of the Nazca – South America Plate boundary region.



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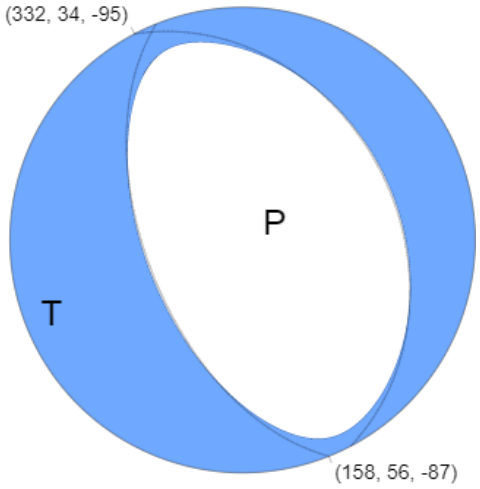
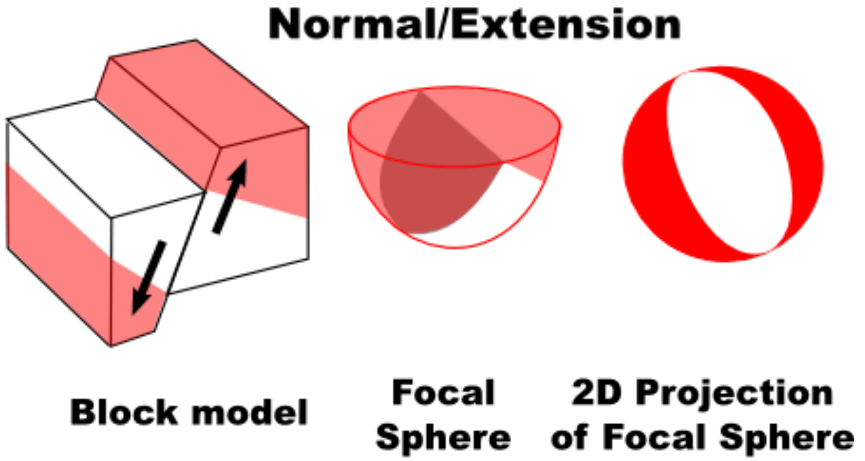
The focal mechanism is how seismologists plot the 3-D stress orientations of an earthquake. An earthquake generates primary (P) waves in quadrants where the first pulse is compressional (shaded) and quadrants where the first pulse is extensional (white). The orientation of these quadrants determined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

A deep-focus earthquake has a hypocenter depth exceeding 300 km. Deep earthquakes occur exclusively within subducting oceanic lithosphere. The physical mechanism of rupture of deep focus earthquakes is different than earthquakes that occur at a shallow depth. This earthquake occurred within the subducting Nazca Plate.



USGS Centroid Moment Tensor Solution



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

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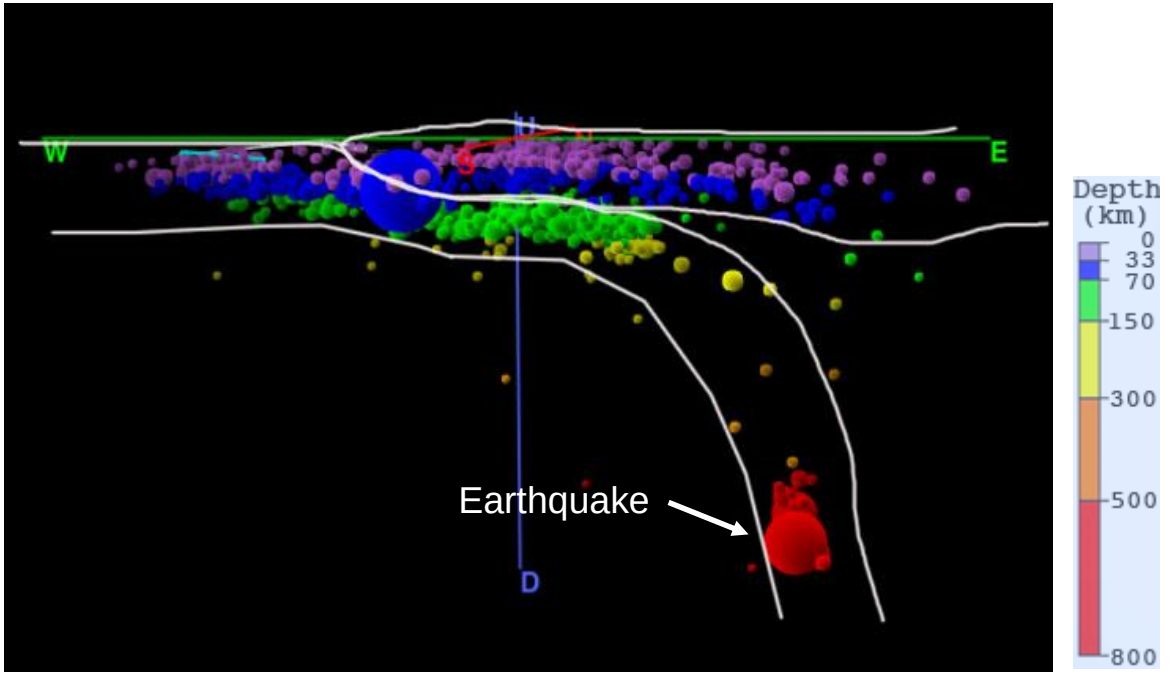
To produce earthquakes, rocks must be brittle so they can accumulate elastic energy as they bend then rapidly release that energy during earthquake rupture. Rocks are brittle at low temperatures but become viscoelastic when they reach temperatures of about 600 ° C.

With the exception of subducting oceanic plates, rock in Earth's mantle below about 100 km depth is viscoelastic and cannot rupture to produce earthquakes.

However, rapidly subducting cool oceanic plates can reach depths up to about 700 km into the hot mantle and continue to produce earthquakes. The deepest earthquakes are thought to be due to phase changes of minerals in the high pressure and temperature conditions at those depths.



Exploring a three-dimensional view from the IRIS Earthquake Browser.

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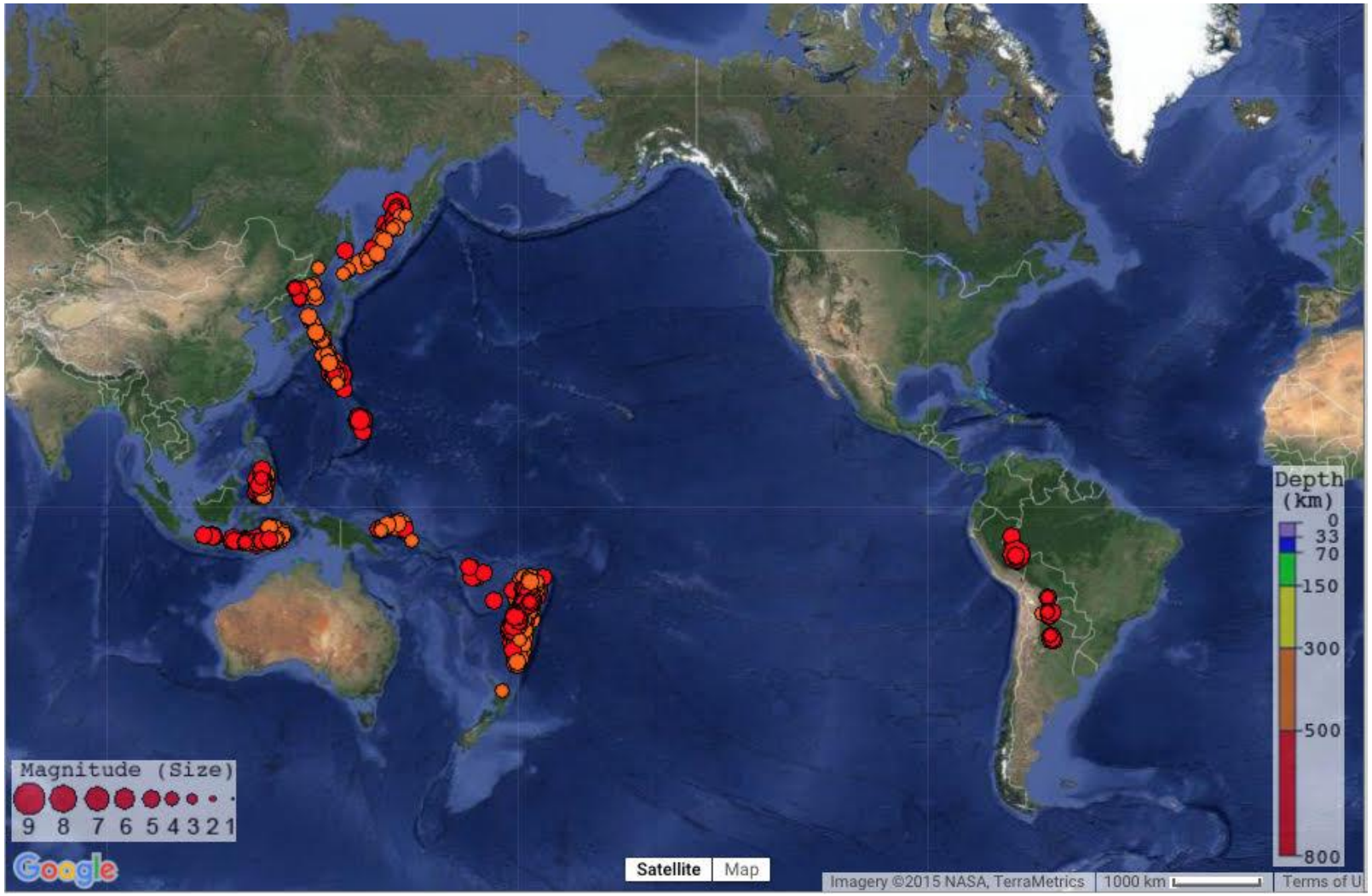
Locations where these deep large earthquake occur.



Map created using the IRIS Earthquake Browser: *www.iris.edu/ieb*

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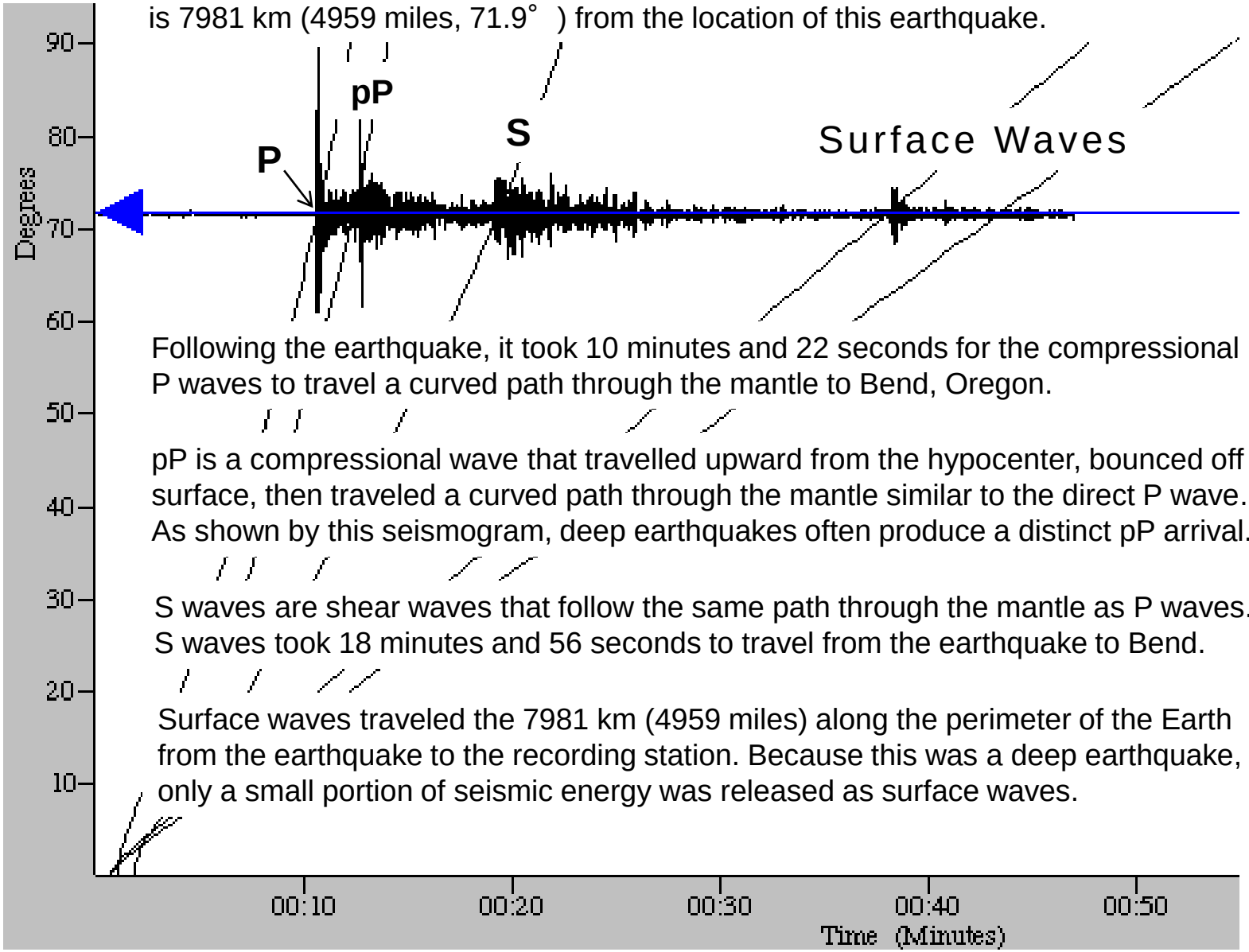
The record of the earthquake in Bend, Oregon (BNOR) is illustrated below. Bend is 7981 km (4959 miles, 71.9˚) from the location of this earthquake.



Following the earthquake, it took 10 minutes and 22 seconds for the compressional P waves to travel a curved path through the mantle to Bend, Oregon.

pP is a compressional wave that travelled upward from the hypocenter, bounced off the surface, then traveled a curved path through the mantle similar to the direct P wave. As shown by this seismogram, deep earthquakes often produce a distinct pP arrival.

S waves are shear waves that follow the same path through the mantle as P waves. S waves took 18 minutes and 56 seconds to travel from the earthquake to Bend.

Surface waves traveled the 7981 km (4959 miles) along the perimeter of the Earth from the earthquake to the recording station. Because this was a deep earthquake, only a small portion of seismic energy was released as surface waves.

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