Magnitude 7.6 & 7.6 PERU

Tuesday, November 24, 2015 at 22:45:38 UTC
Tuesday, November 24, 2015 at 22:50:52 UTC

Two deep 7.6 magnitude earthquakes have shaken a sparsely populated jungle region near the Peru-Brazil border in southeast Peru. There were no immediate reports of injuries or damage.

The second M 7.6 earthquake followed the first by 5 minutes; the events were separated by approximately 50 km horizontally and 6 km vertically.

The second earthquake was almost certainly triggered by the first earthquake.

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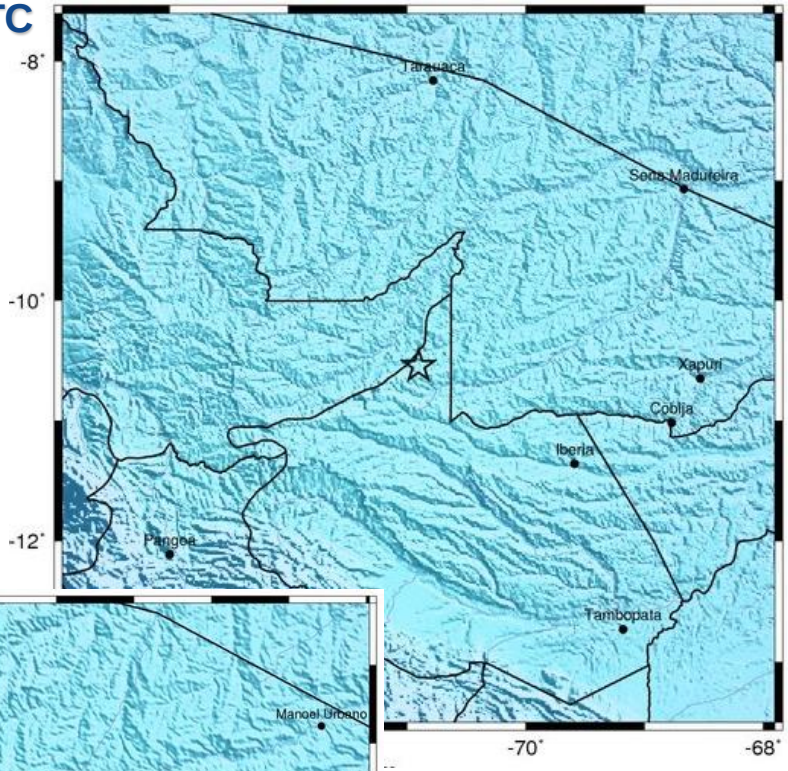
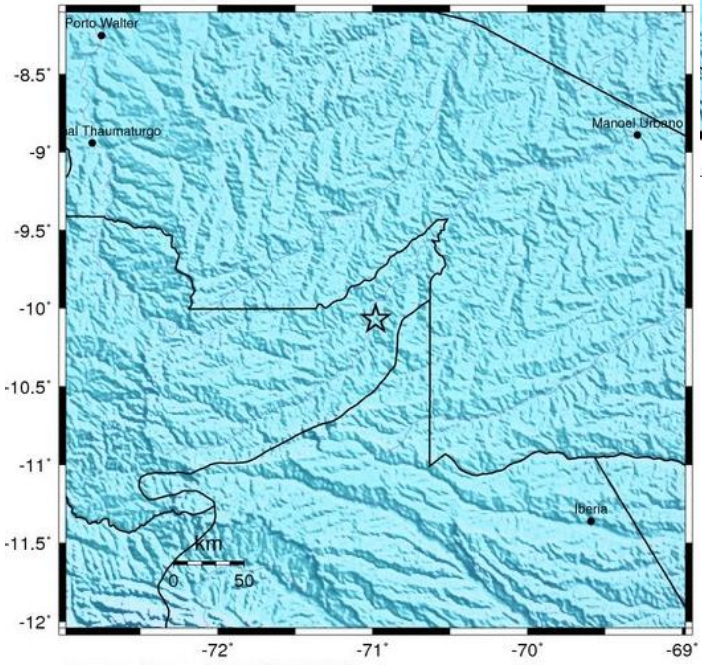
The Modified-Mercalli Intensity scale is a twelve-stage scale, from I to XII, that indicates the severity of ground shaking.

The entire region experienced weak shaking from both of these earthquakes due to their depth, both greater than 600 km (373 miles).



2245 UTC Earthquake



USGS Estimated Shaking Intensities

2250 UTC Earthquake

Image courtesy of the US Geological Survey

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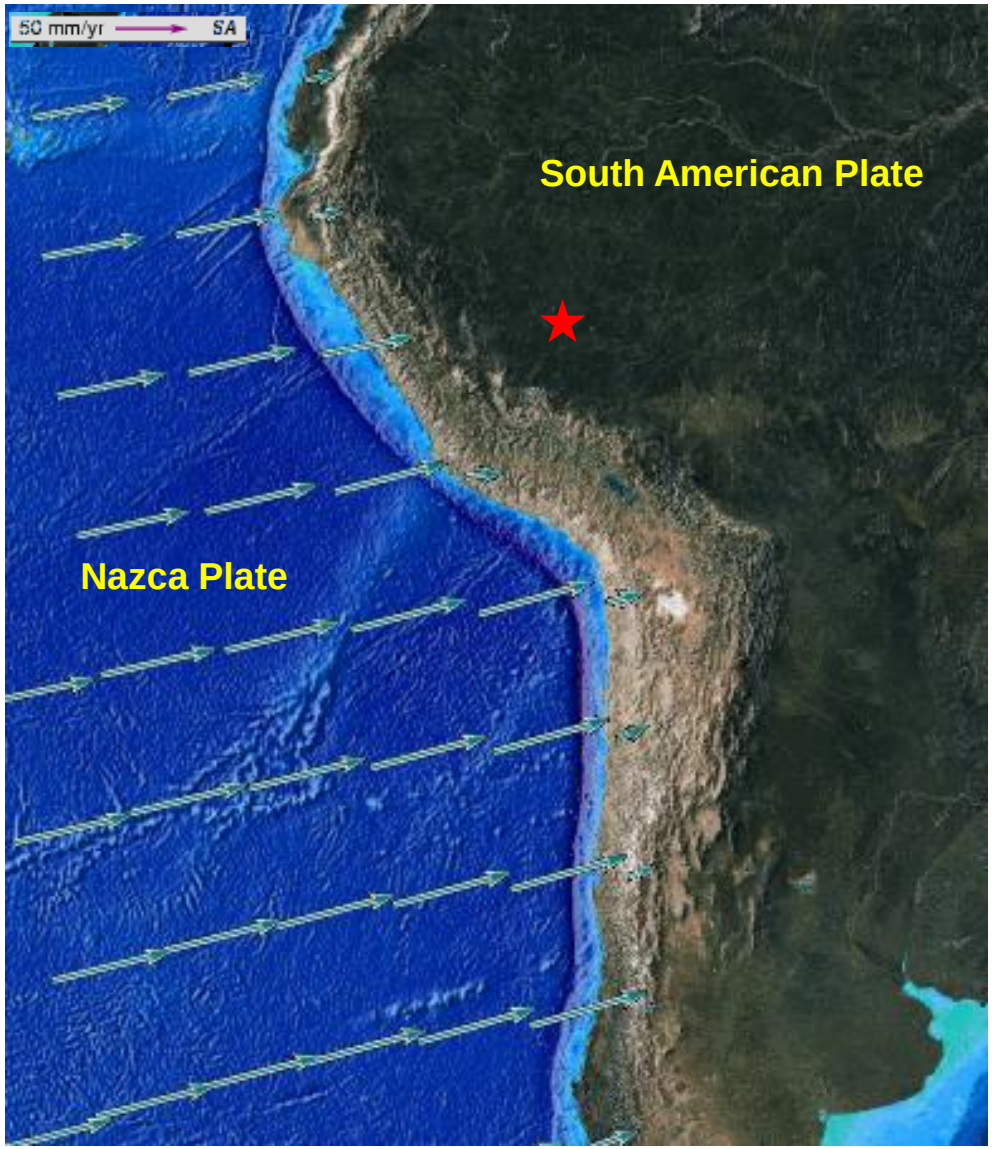
This map shows the rate and direction of motion of the Nazca Plate with respect to the South American Plate.

At the location of the earthquakes, the Nazca Plate subducts to the east under the South America Plate at a velocity of about 69 mm/yr.



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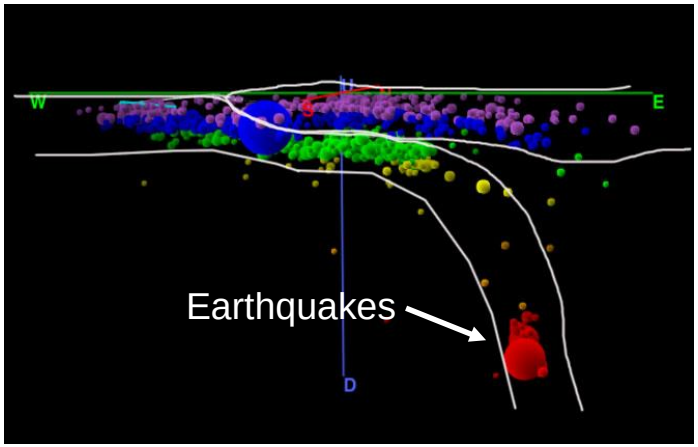
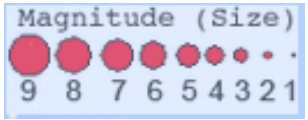
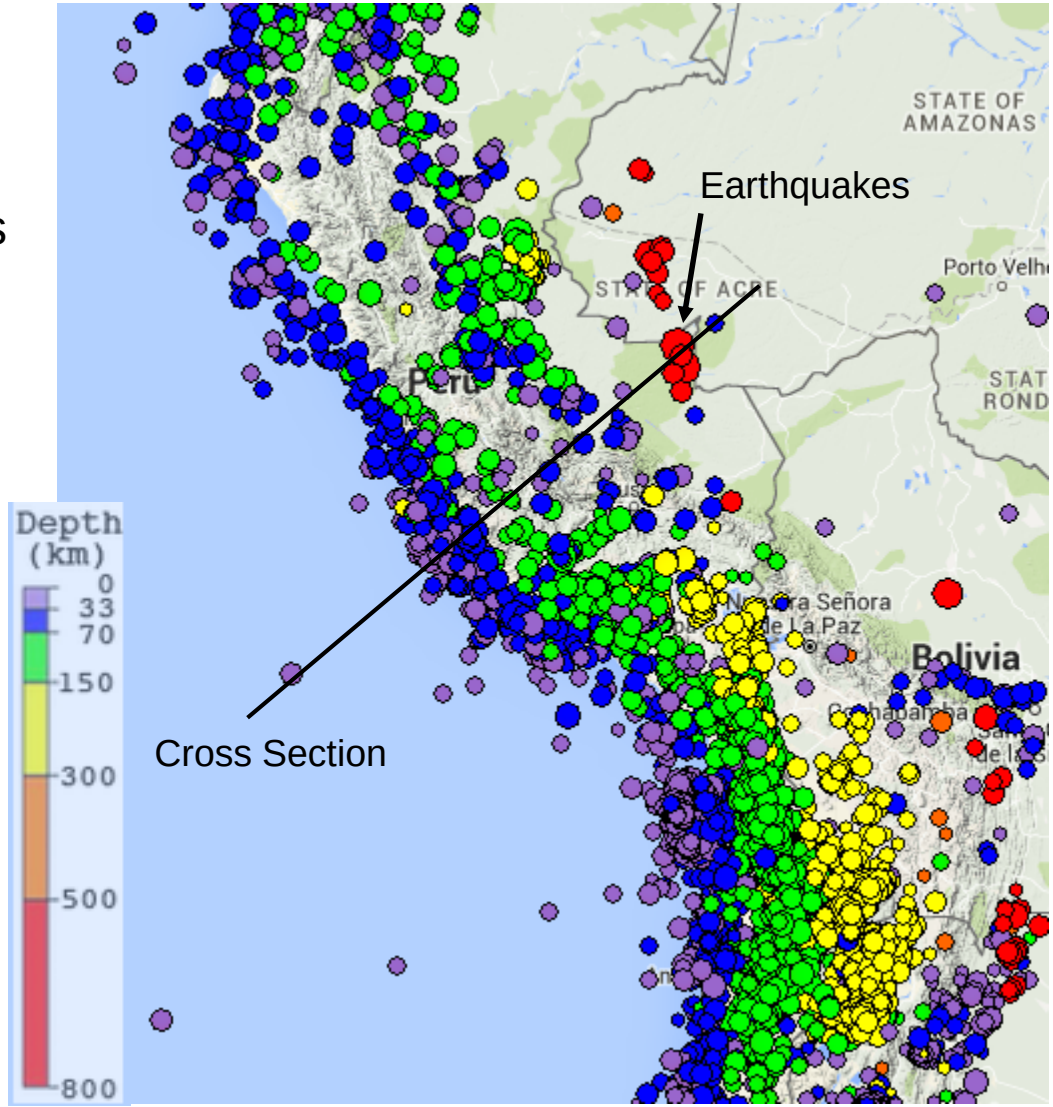
Epicenters are shown on a map of regional historic seismicity on the right. On the cross section below, intermediate and deep earthquakes within the Nazca Plate illustrate its angle of subduction beneath the South American Plate.







Map generated using Interactive IRIS Earthquake Browser

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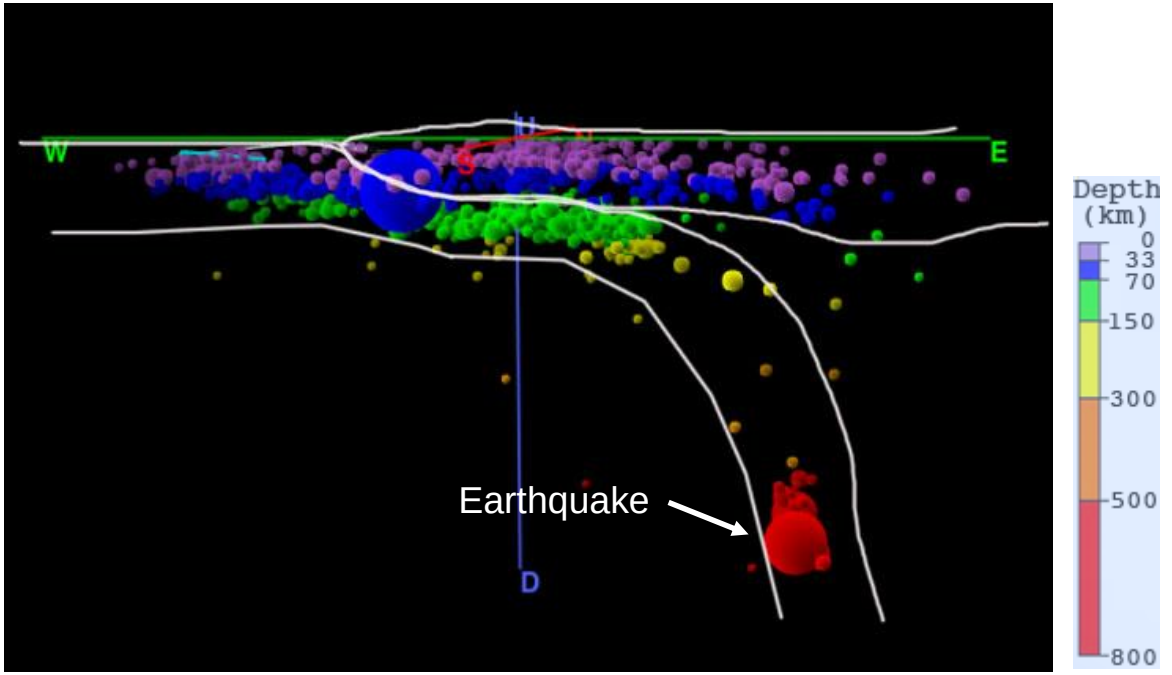
To produce earthquakes, rocks must be brittle so they can accumulate elastic energy as they bend then rapidly release that energy during earthquake rupture. Rocks are brittle at low temperatures but become viscoelastic when they reach temperatures of about 600 ° C.

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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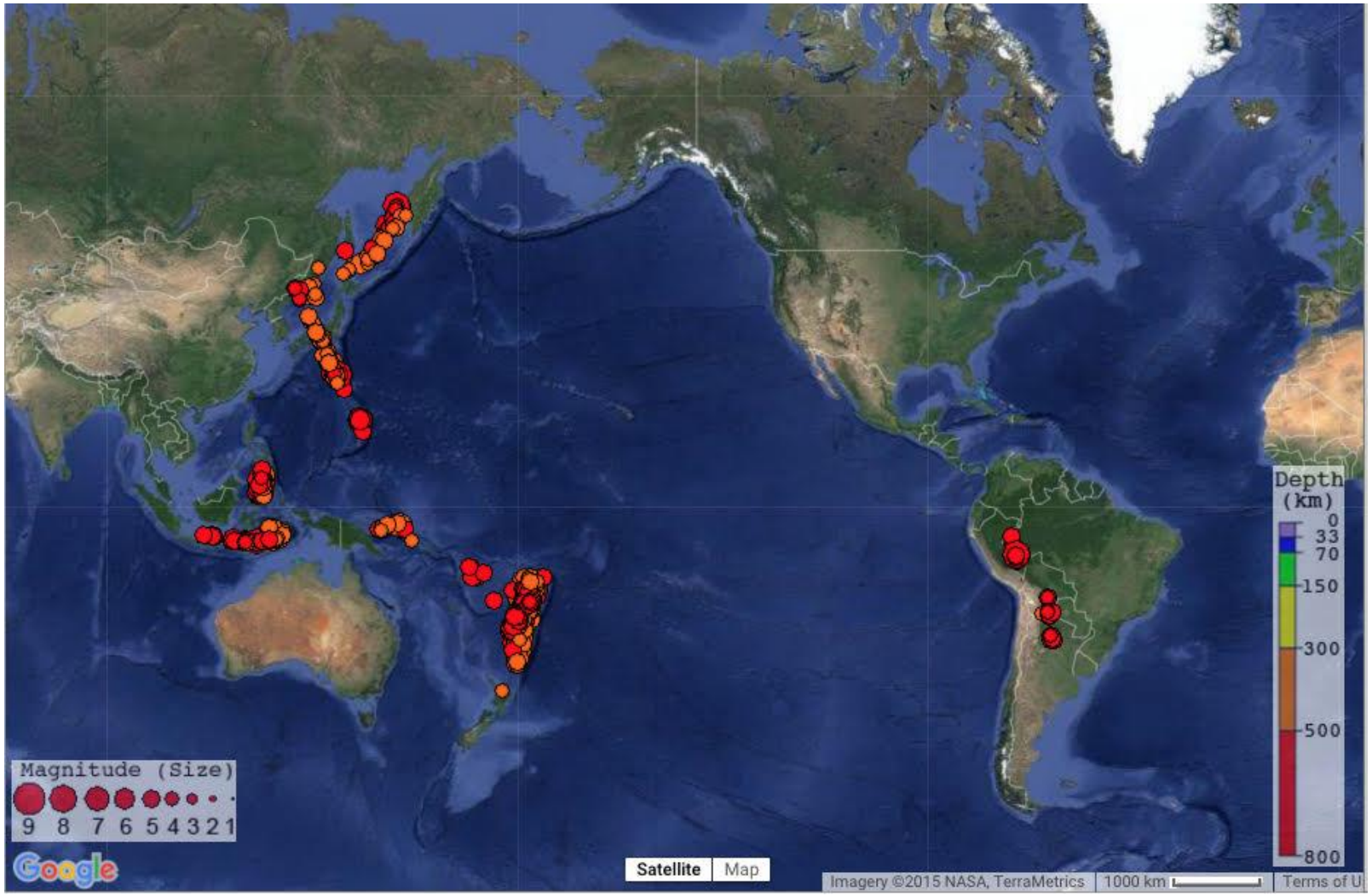
Locations where these deep large earthquake occur.



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

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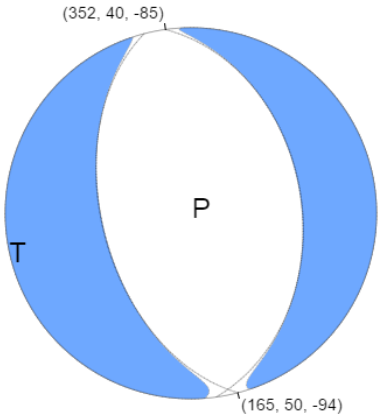
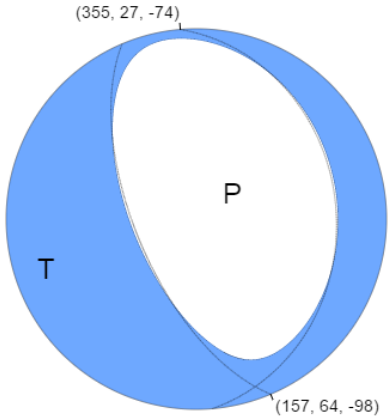


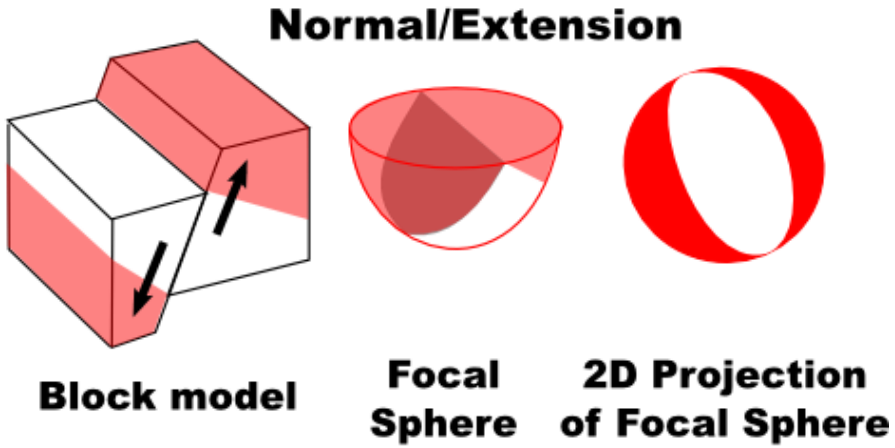
2245 UTC



2250 UTC

Both earthquakes occurred as the result of normal faulting at a depth of approximately 600 km, almost 700 kilometers east of the Peru-Chile Trench within the subducted oceanic lithosphere of the Nazca Plate.

The two events also had approximately the same focal mechanism. Focal mechanisms indicate rupture occurred on a normal fault dipping moderately to either the east-northeast or to the west-southwest.



Shaded areas show quadrants of the focal sphere in which the P-wave first-motions are away from the source, and unshaded areas show quadrants in which the P-wave first-motions are toward the source. The letters represent the axis of maximum compressional strain (P) and the axis of maximum extensional strain (T) resulting from the earthquake.

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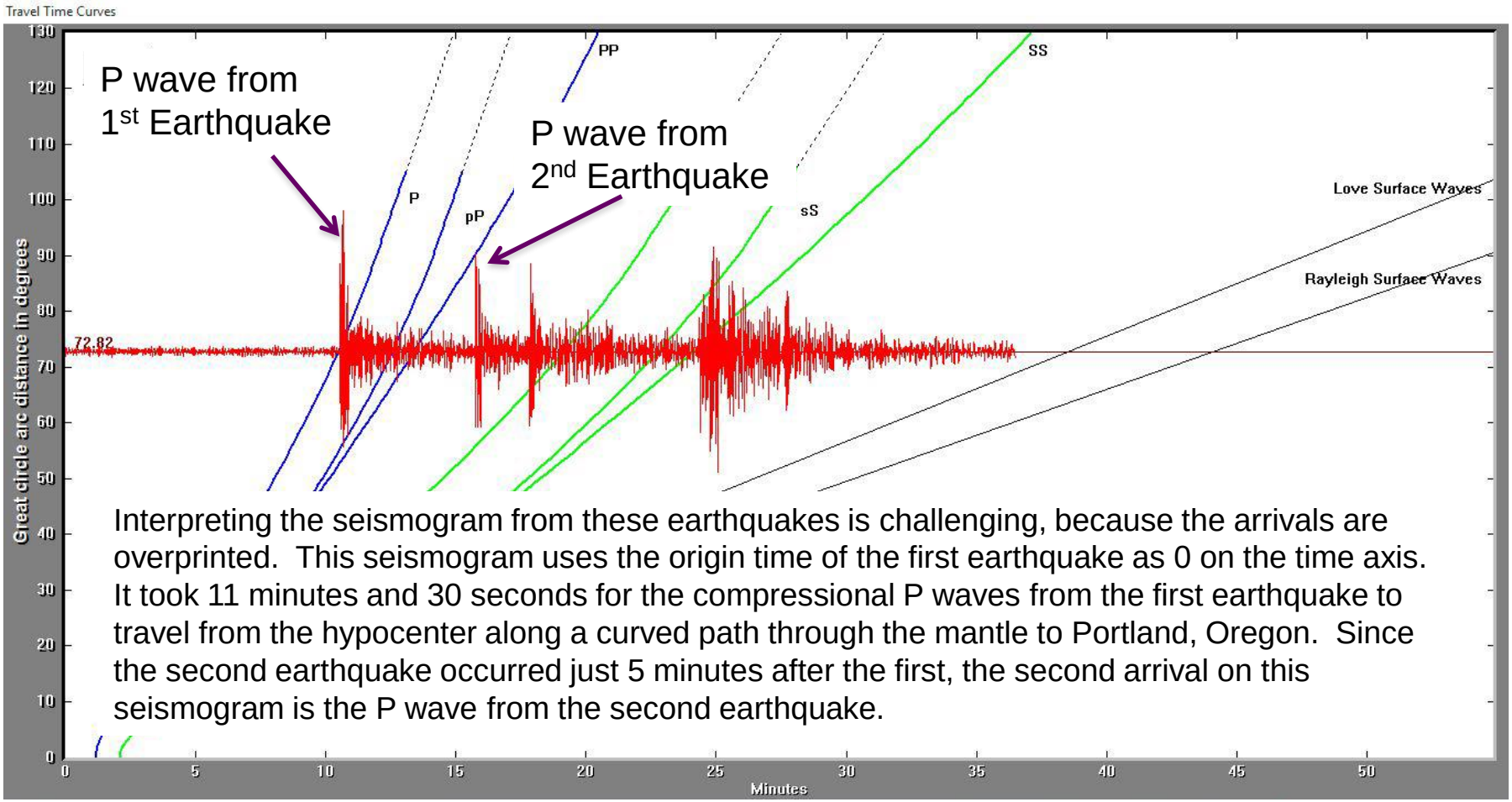
The record of the M7.6 earthquakes on the University of Portland seismometer (UPOR) is illustrated below. Portland is 8087 km (5025 miles, 72.86˚) from this earthquake.



Interpreting the seismogram from these earthquakes is challenging, because the arrivals are overprinted. This seismogram uses the origin time of the first earthquake as 0 on the time axis. It took 11 minutes and 30 seconds for the compressional P waves from the first earthquake to travel from the hypocenter along a curved path through the mantle to Portland, Oregon. Since the second earthquake occurred just 5 minutes after the first, the second arrival on this seismogram is the P wave from the second earthquake.

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