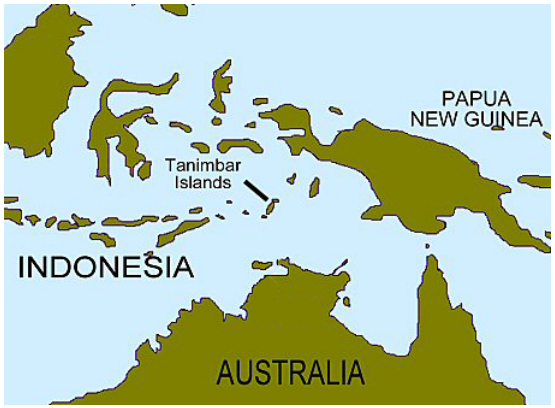
Magnitude 7.1 BANDA SEA

Wednesday, November 8, 2023 at 04:53:51 UTC

Latitude 6.456° S
Longitude 129.513° E
Depth 10 km

A magnitude 7.1 earthquake has occurred in Indonesia's Banda Sea region. The shallow M 7.1 earthquake was preceded approximately 1 minute earlier by an M 6.7 earthquake, referred to as a foreshock, with a similar mechanism and location. There were no immediate reports of damage or casualties, and no tsunami warnings were issued.

The epicenters of both earthquakes were at sea, located 255 km (158 miles) from the Tanimbar Islands in Indonesia's Maluku province. The islands are about 420 km (261 miles) off Australia's Northern Territory.



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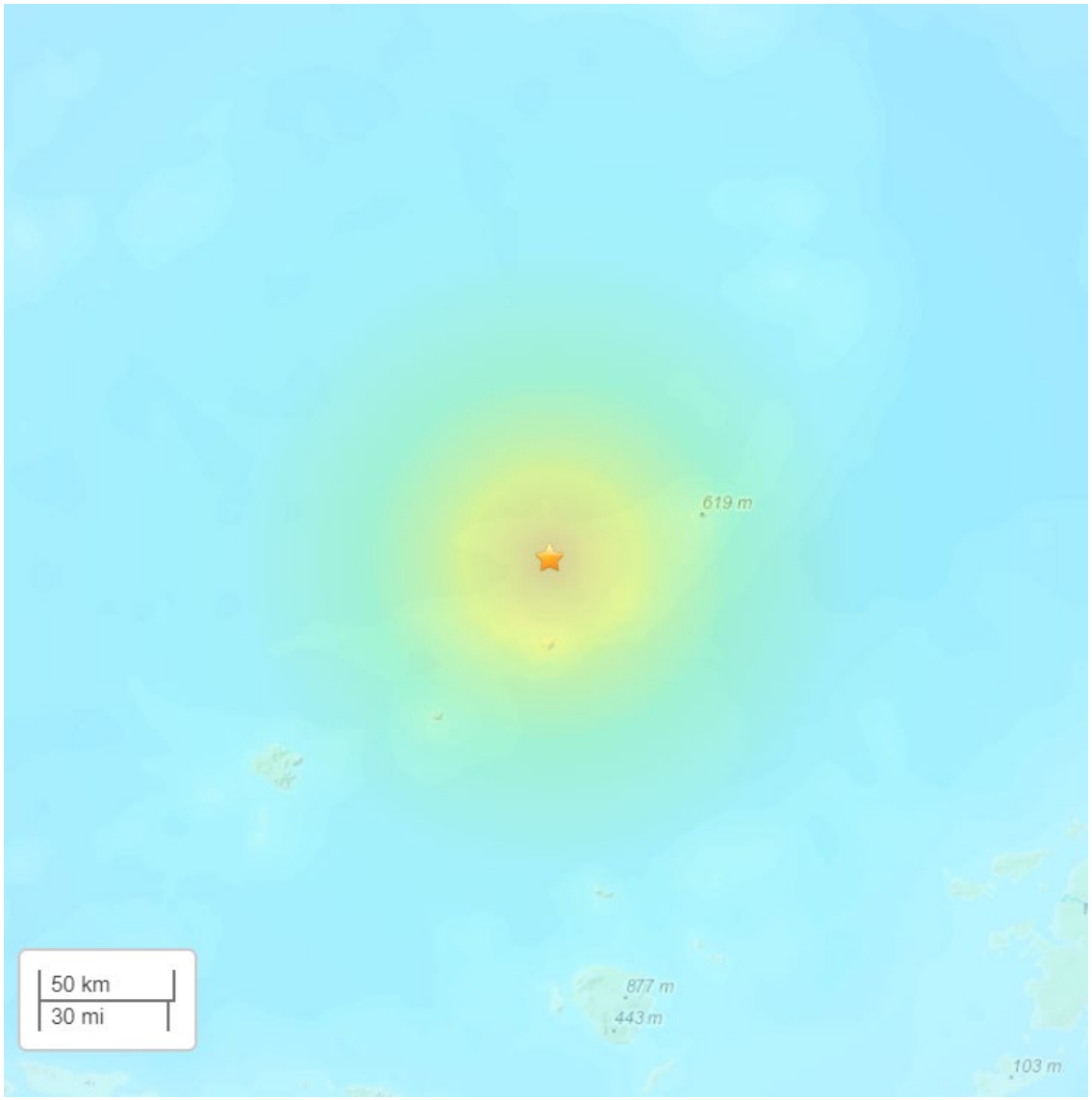
The Modified-Mercalli Intensity (MMI) scale is a ten-stage scale, from I to X, that indicates the severity of ground shaking. Intensity is based on observed effects and is variable over the area affected by an earthquake. Intensity is dependent on earthquake size, depth, distance, and local conditions.

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 7.1 Earthquake

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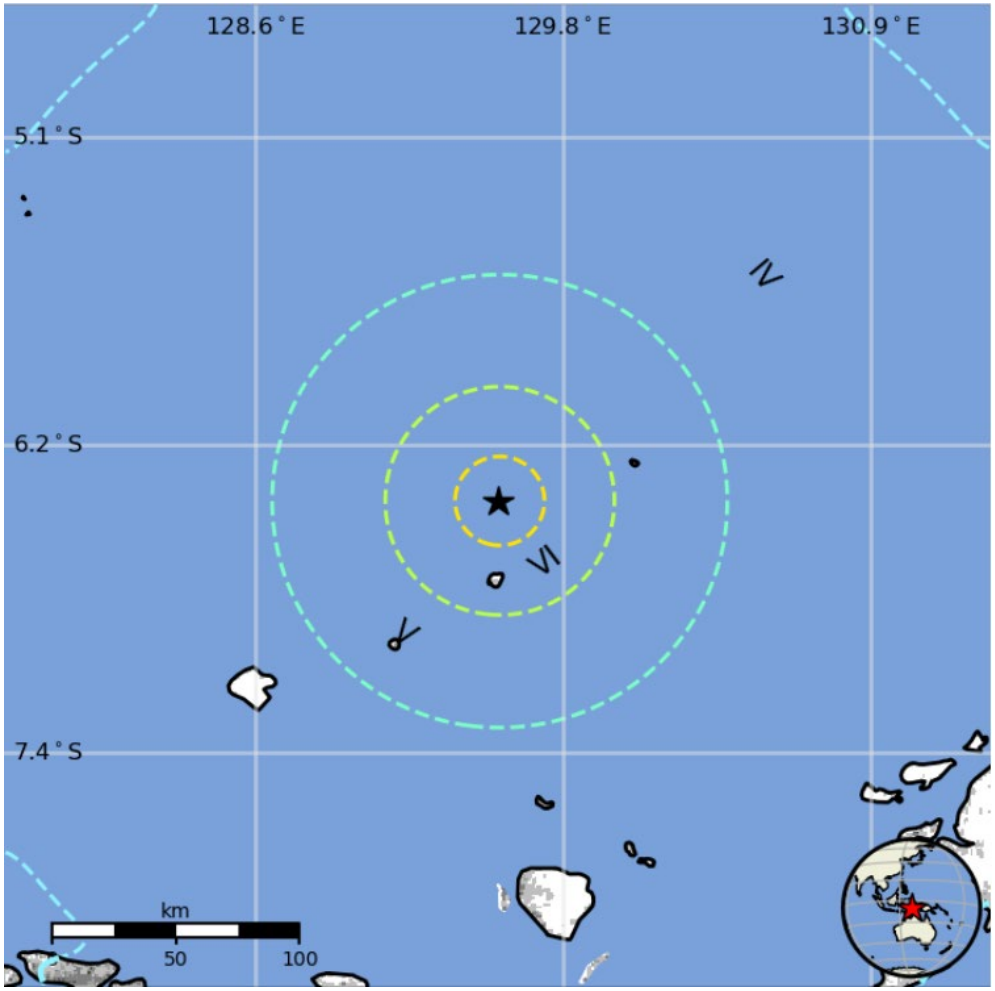
The USGS PAGER map shows the population exposed to different Modified Mercalli Intensity (MMI) levels. The USGS estimates that 92,000 people felt light shaking from this M 7.1 earthquake.

MMI	Shaking	Population
I	Not Felt	0 k*
II-III	Weak	24 k*
IV	Light	92 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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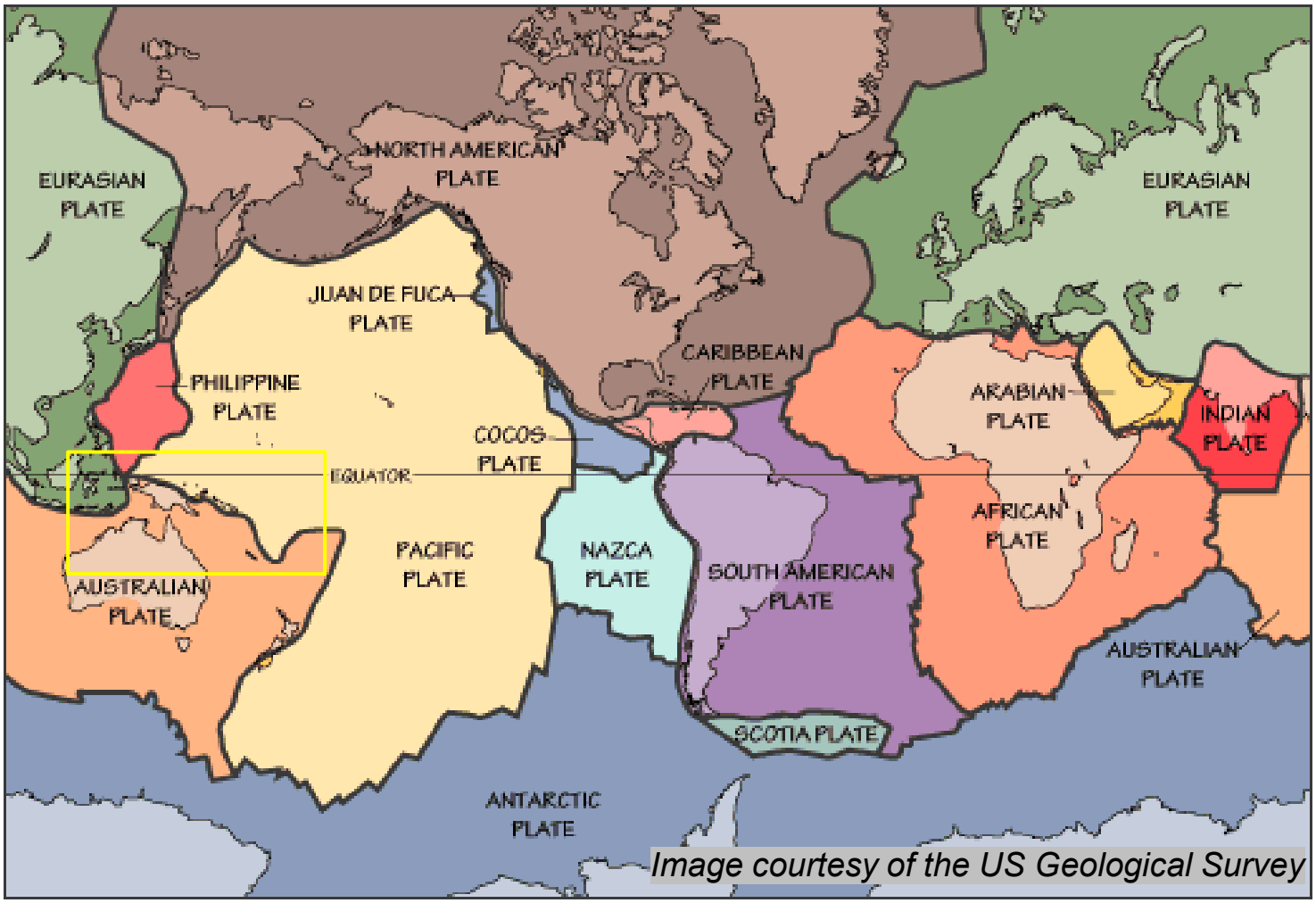

The Sunda – Java Trench and Timor Trench are the convergent plate boundary where the Australia Plate subducts beneath the Sunda Plate (southeastern promontory on the Eurasian Plate). The tectonics and seismicity of the region within the yellow rectangle are shown on the next slide.

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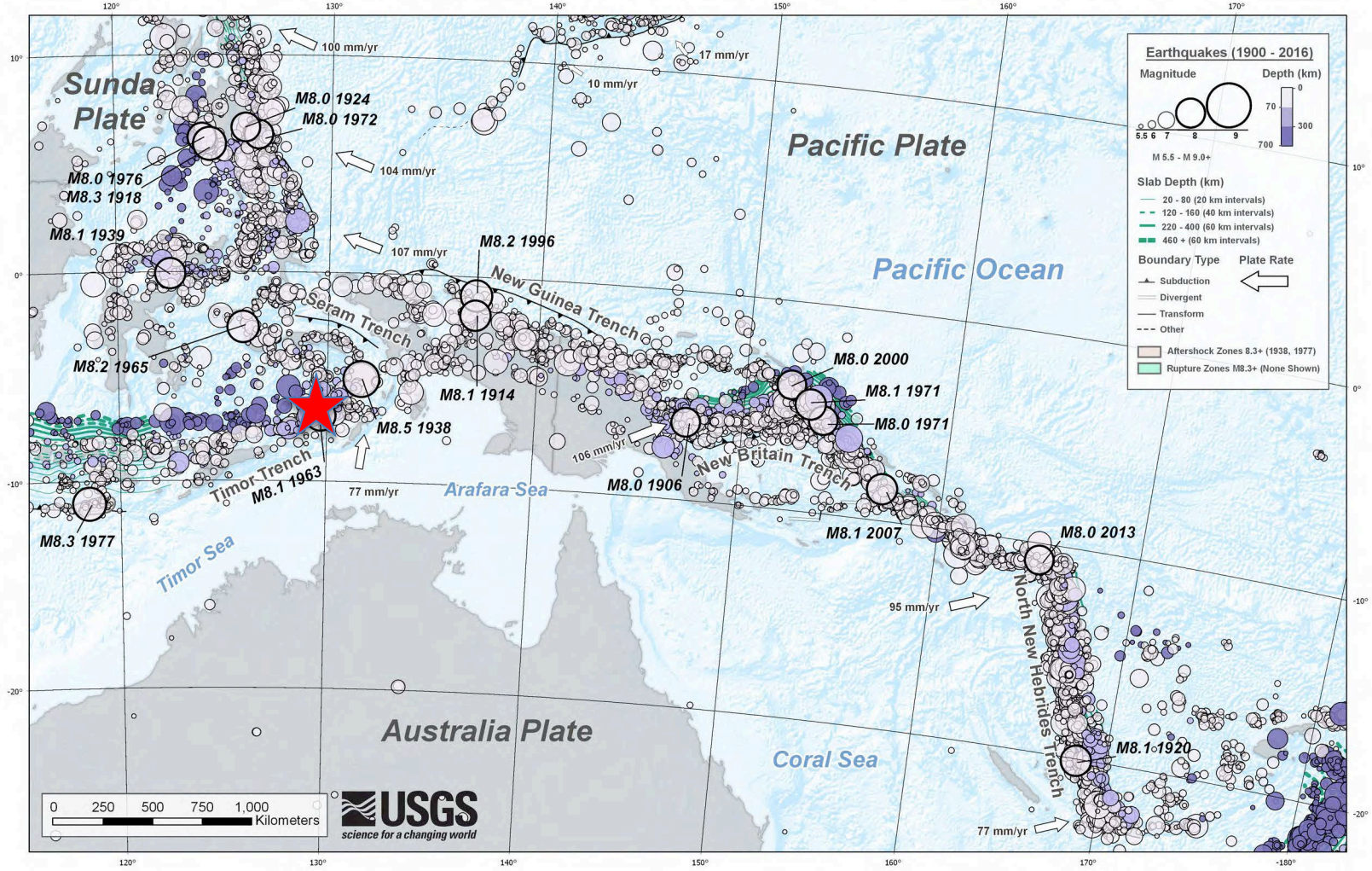

Earthquake history from 1900 to 2016 and rates of subduction are shown on the map above. In this region, convergence between the Australia, Pacific, and Sunda plates has produced subduction zones in some areas and distributed belts of earthquakes in other areas. The red star indicates the epicenter of the November 8, 2023 earthquake. Just east of the epicenter, the Australia Plate subducts into the Timor Trench at a rate of 77 mm/yr.

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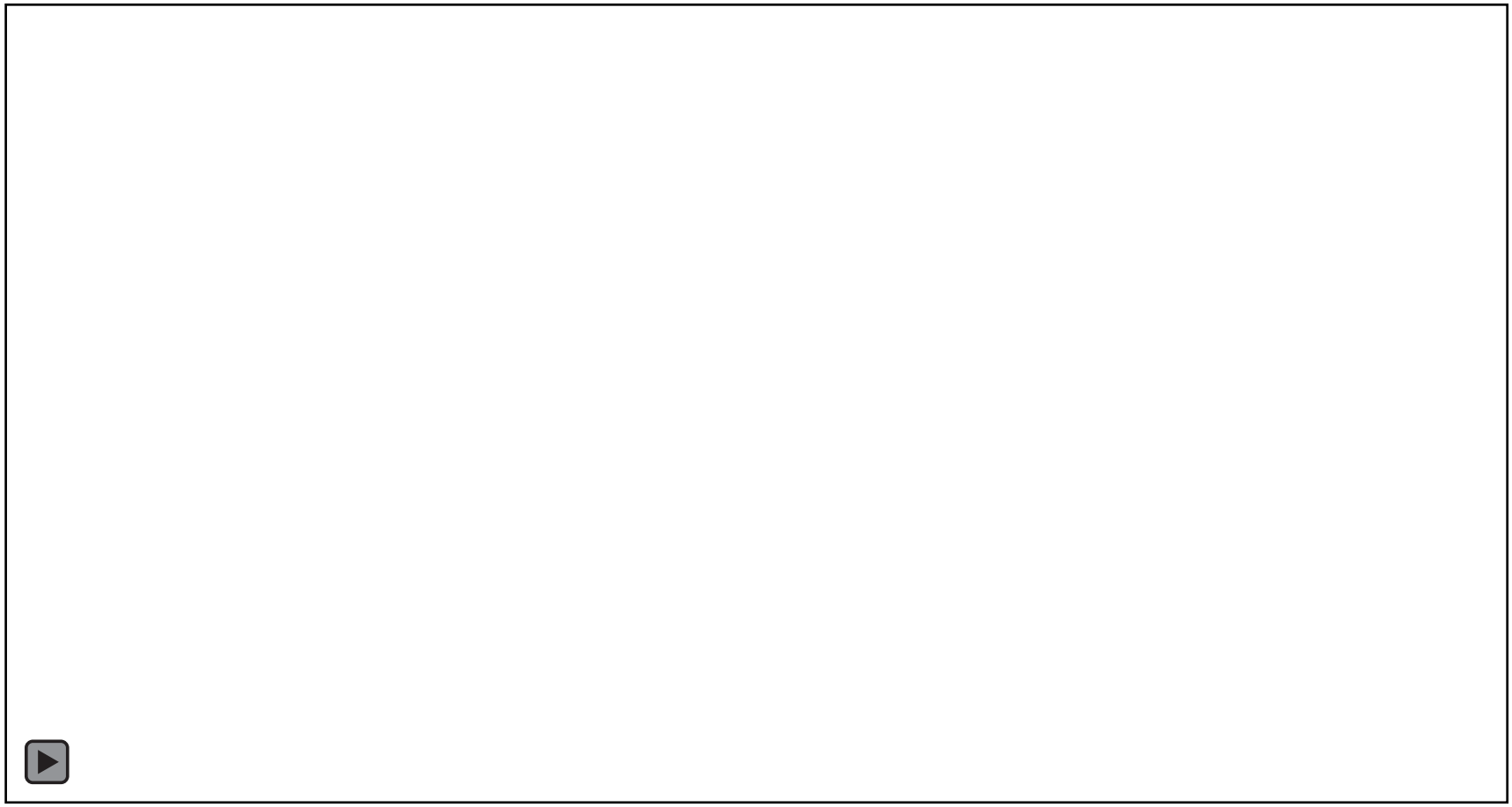
Twenty years of regional seismicity greater than magnitude 5 are animated, shown color coded by depth. Notice that earthquakes are shallow on the south edge of the map area. As the oceanic portion of the Australia Plate subducts towards the north beneath the Sunda Plate, earthquakes within the Australia Plate increase in depth from south to north.



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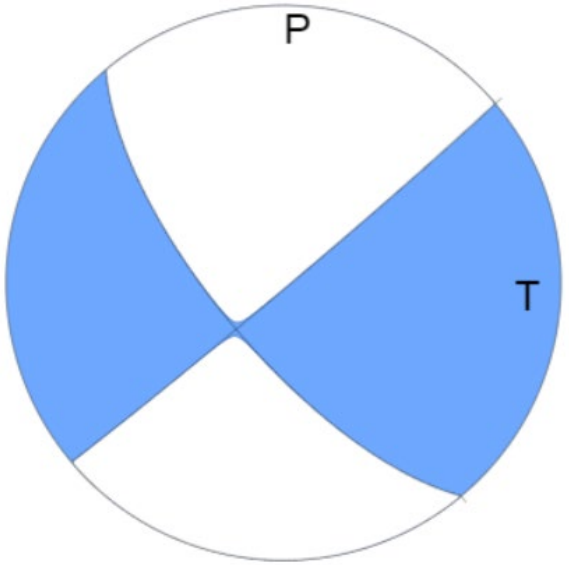
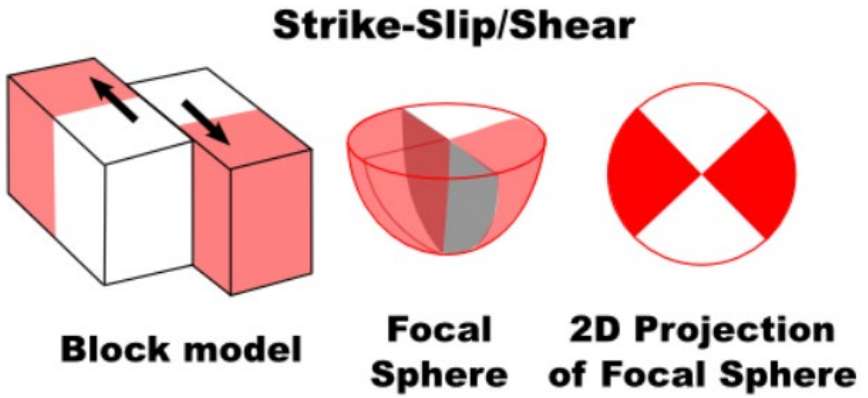
The location, depth and focal mechanism indicate this earthquake in the Banda Sea occurred as a result of strike-slip faulting.

This focal mechanism solution indicates that rupture occurred on either a left-lateral northeast-striking fault or a right-lateral southeast-striking fault.



USGS W-phase Moment Tensor Solution



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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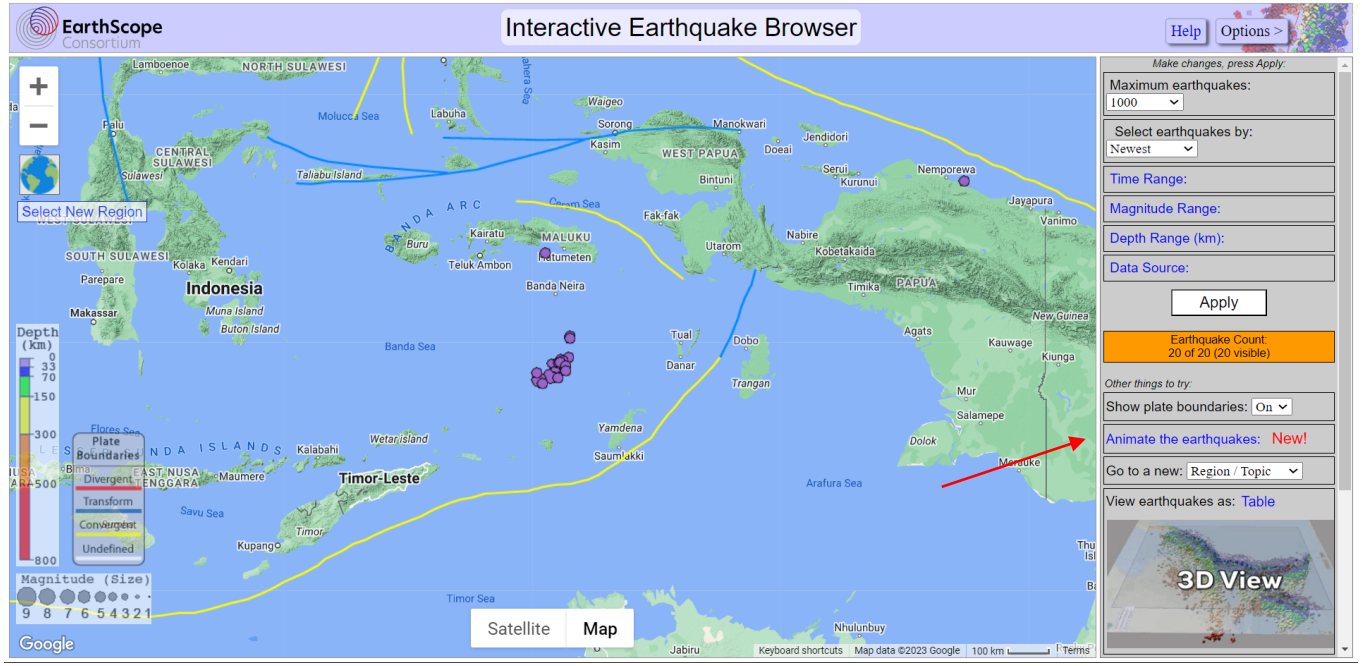
This shallow M 7.1 earthquake was preceded approximately 1 minute earlier by an M 6.7 foreshock, and thus far 16 aftershocks ranging from M 4.4 – M 6.7.

- Animate the aftershocks at https://tinyurl.com/Banda-earthquakes



- Notice the SW – NE alignment of the aftershocks. The pattern of aftershocks can help confirm characteristics of the area that slipped during the main shock. This distribution indicates that of the two potential interpretations of the focal mechanism, this earthquake was likely produced by left-lateral strike-slip faulting on a NE – SW oriented fault plane.

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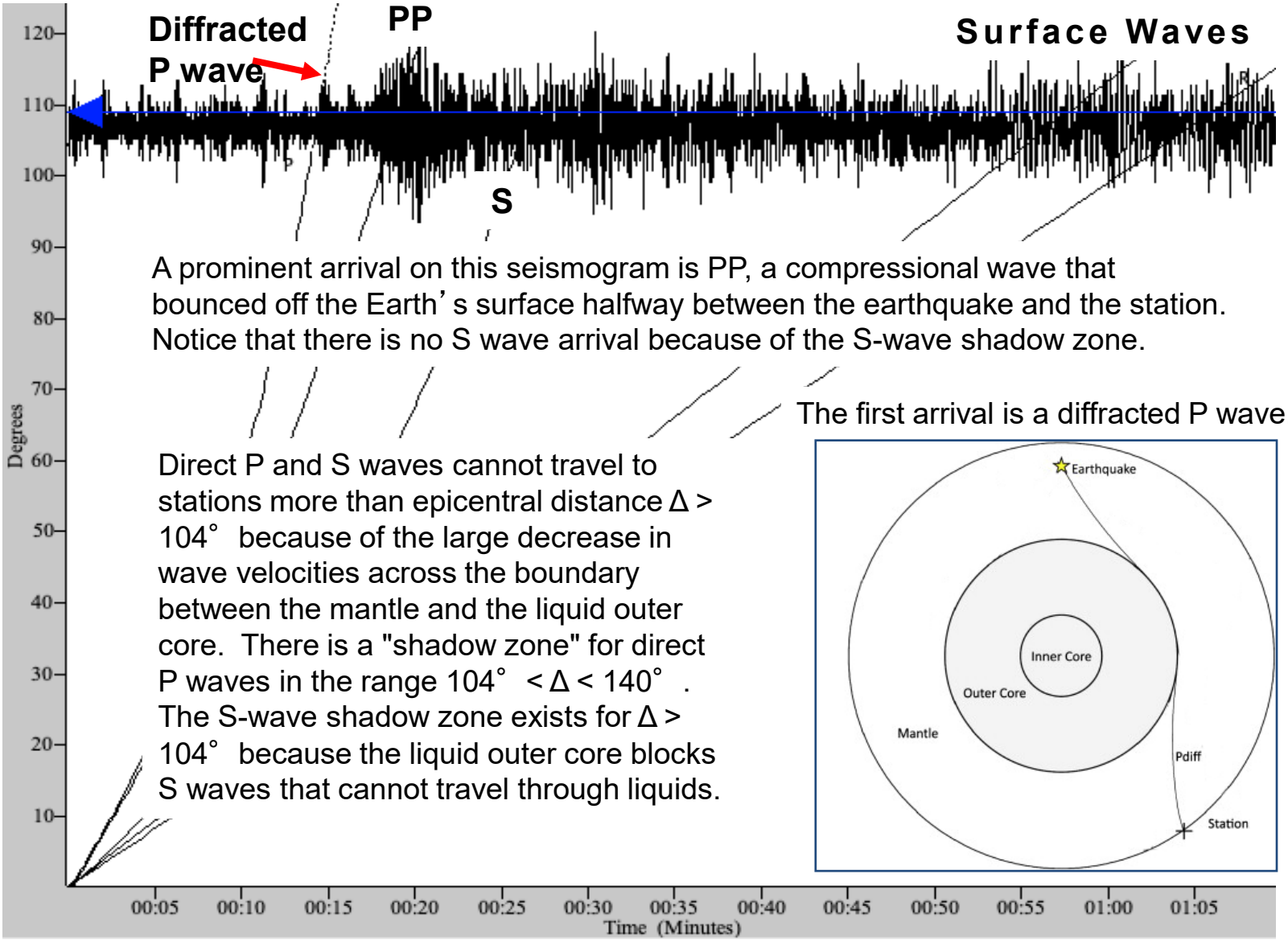
The record of the November 8, 2023 earthquake in Bend, Oregon (BNOR) is illustrated below. Bend is 12,032 km (7,477 miles, 108.4°) from the location of this earthquake.



A prominent arrival on this seismogram is PP, a compressional wave that bounced off the Earth's surface halfway between the earthquake and the station. Notice that there is no S wave arrival because of the S-wave shadow zone.

The first arrival is a diffracted P wave.

Direct P and S waves cannot travel to stations more than epicentral distance Δ > 104° because of the large decrease in wave velocities across the boundary between the mantle and the liquid outer core. There is a "shadow zone" for direct P waves in the range 104° < Δ < 140° . The S-wave shadow zone exists for Δ > 104° because the liquid outer core blocks S waves that cannot travel through liquids.

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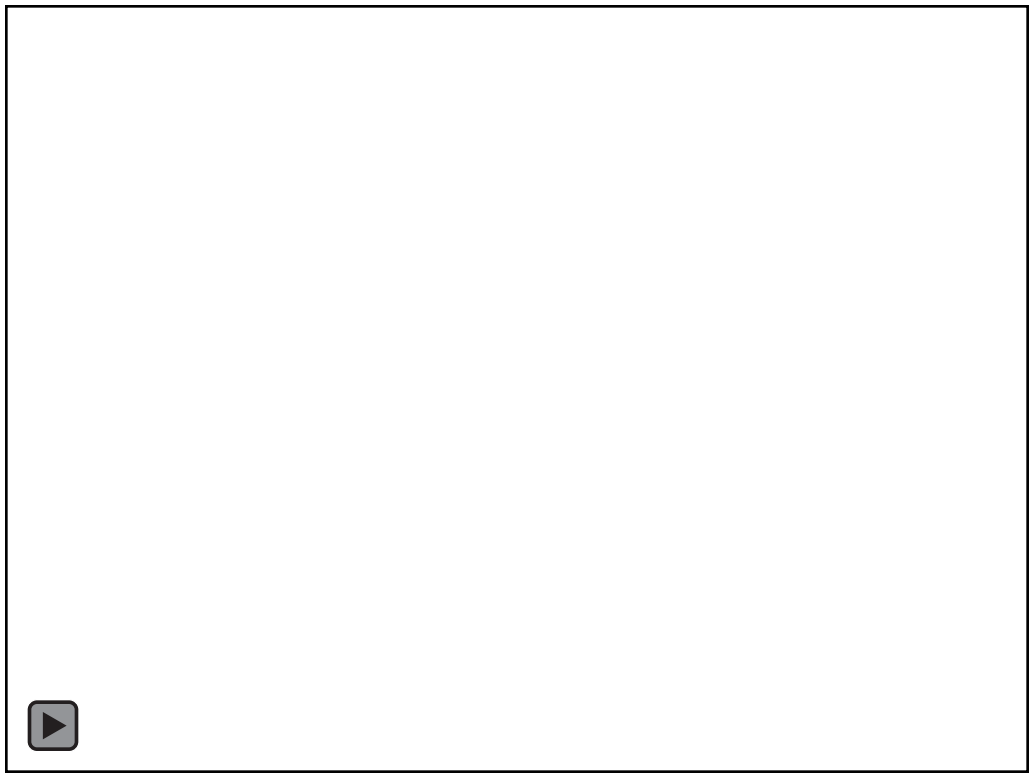
Animation explaining the seismic shadow zone.

Epicentral distance is the angle formed by the intersection of the line from the earthquake to Earth's center with the line from the observing point to the Earth's center.

S waves are observed up to a distance of 104° from an earthquake, but direct S waves are not recorded beyond this distance.

P waves also have a shadow zone between 104° and 140°.



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