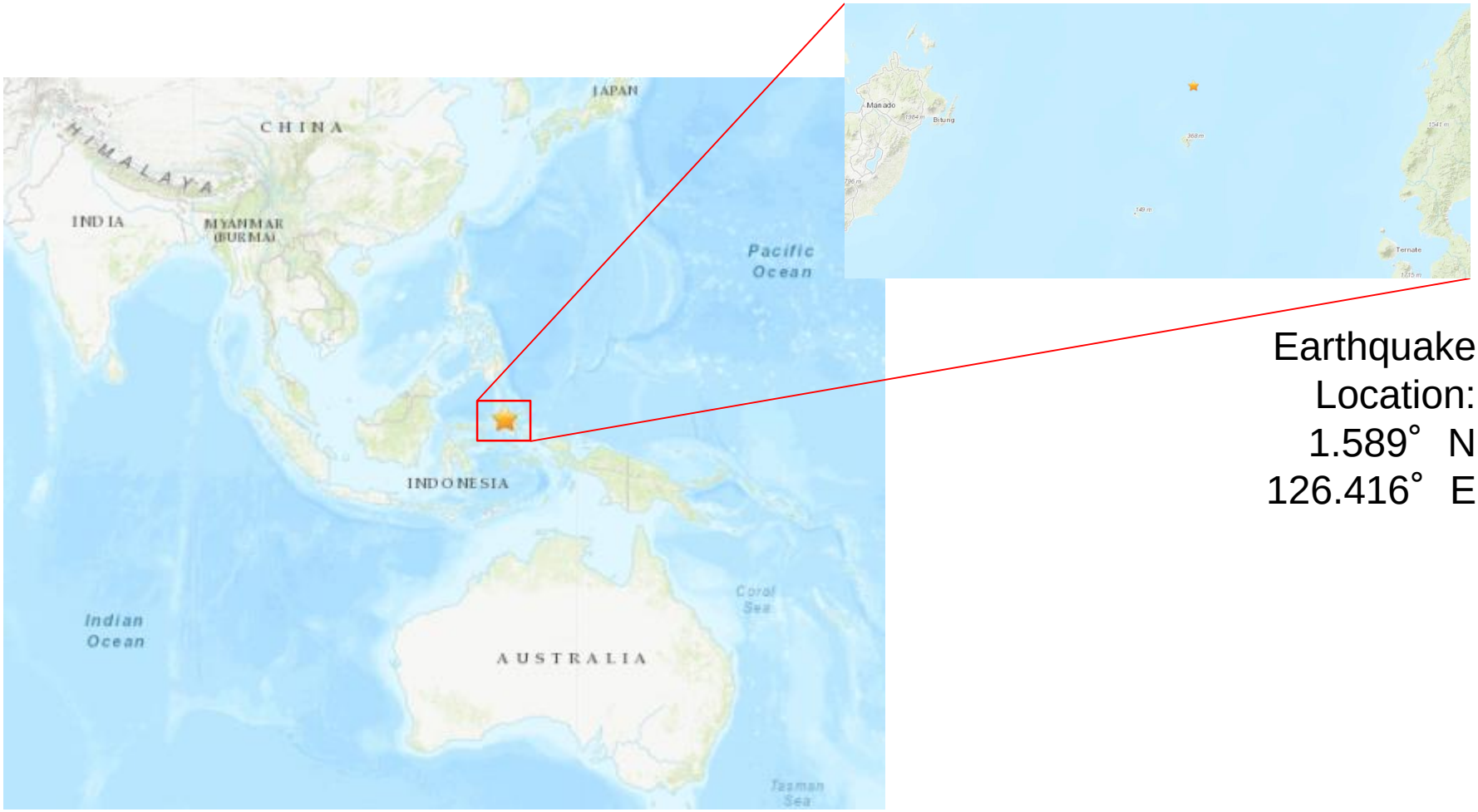
Magnitude 7.1 INDONESIA

Thursday, November 14, 2019 at 16:17:41 UTC

A magnitude 7.1 earthquake occurred 134 km (83 miles) from the port city of Ternate at a depth of 45.1 km (30 miles). There were no immediate reports of injury or damage.



Earthquake Location:
1.589° N
126.416° E

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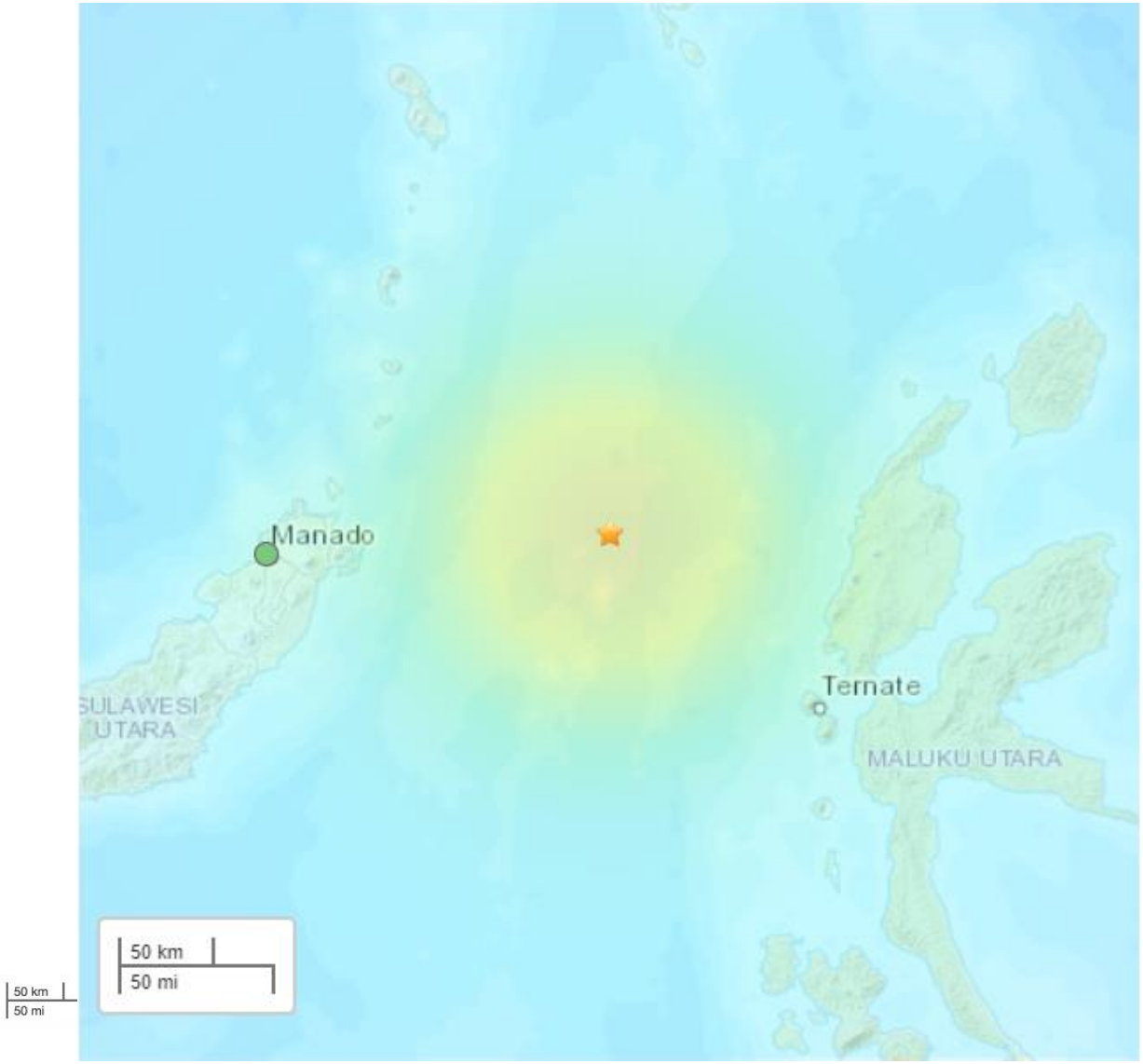
The Modified-Mercalli Intensity (MMI) scale is a twelve-stage scale, from I to XII, that indicates the severity of ground shaking.

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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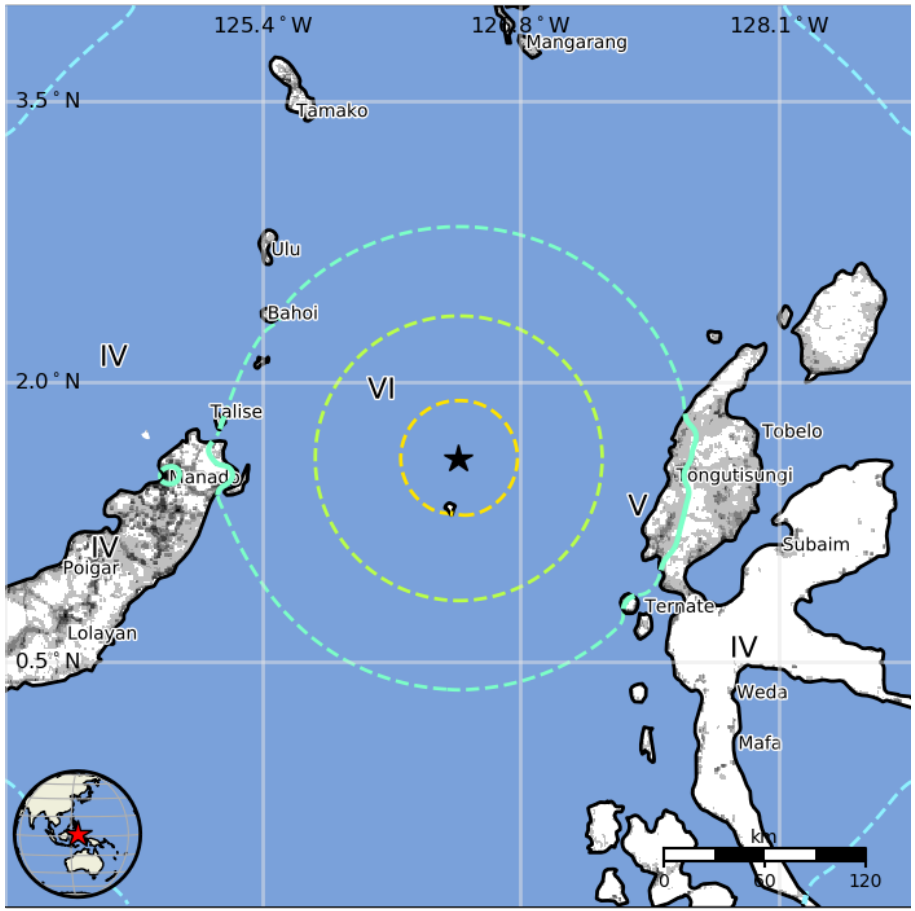
USGS PAGER
Population Exposed to Earthquake Shaking

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

763,000 people were exposed to moderate shaking from this earthquake.

I	Not Felt	0 k*
II-III	Weak	1 k*
IV	Light	2,567 k
V	Moderate	763 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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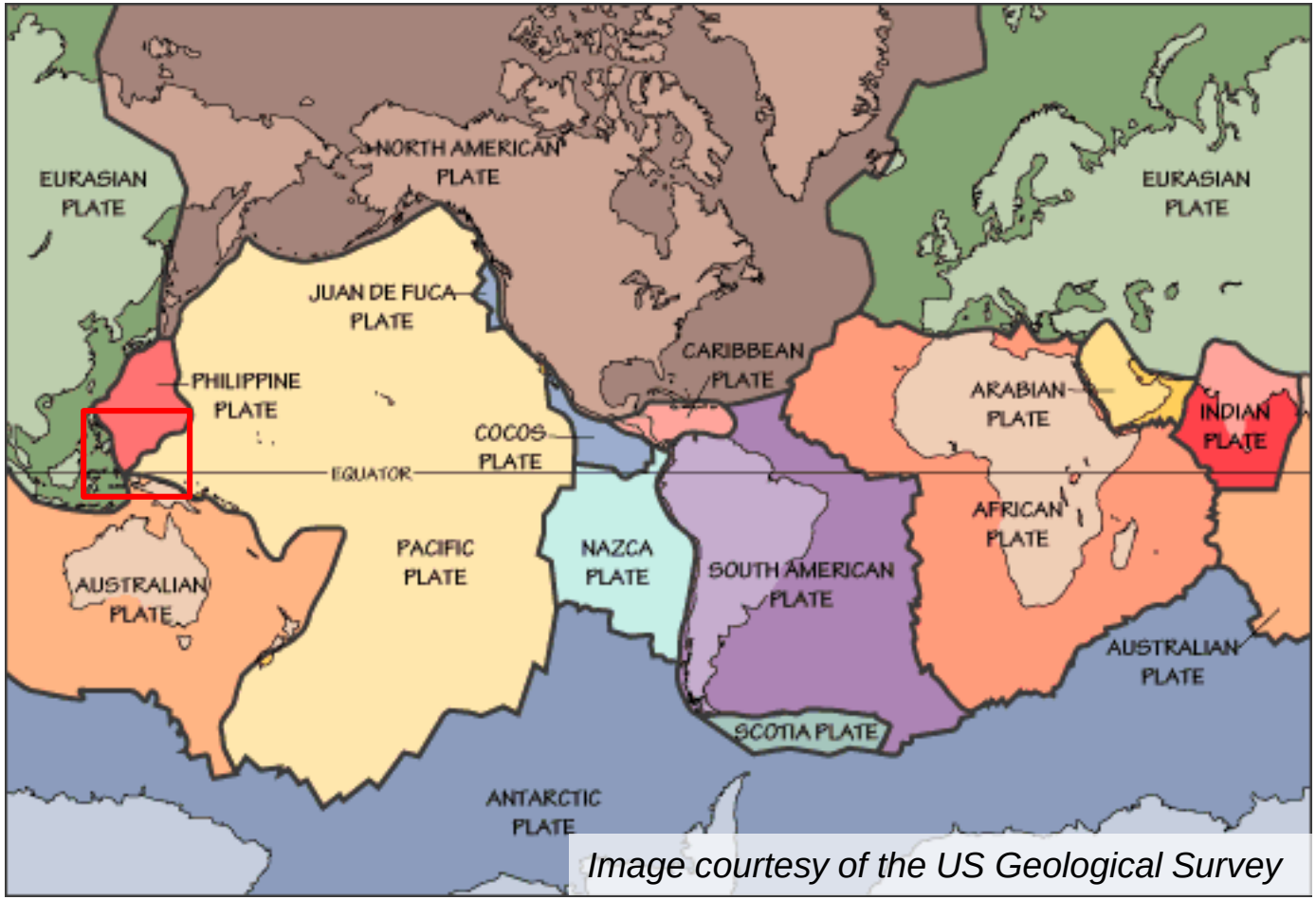

Image courtesy of the US Geological Survey

The Pacific, Philippine, Eurasian, and Australian plates meet in a complex arrangement of subduction zones and microplates. The southeast part of the Eurasian Plate is often referred to as the Sunda Plate. Features within the region outlined by the red square are shown on the next slide.

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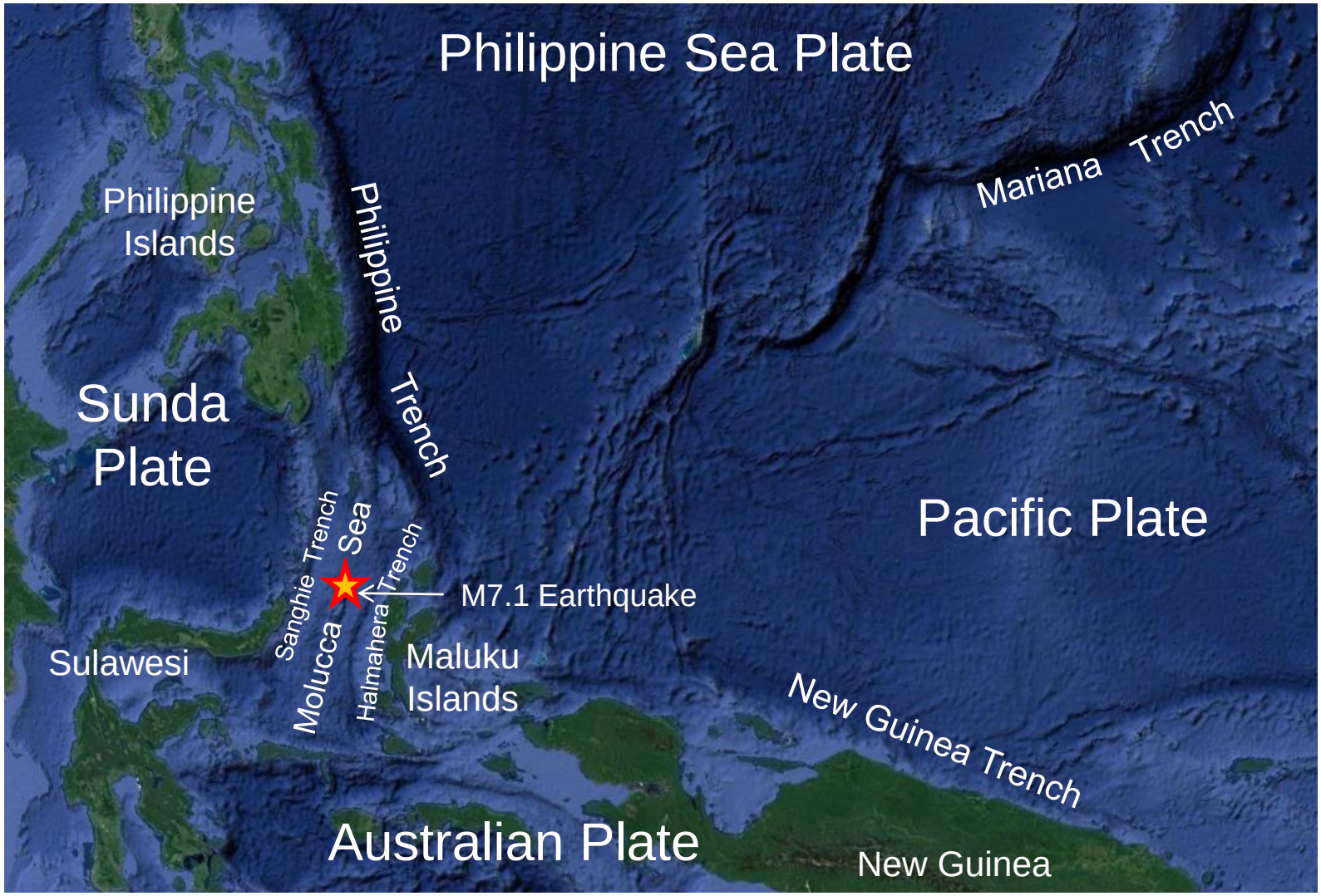

In this complicated region of convergence between four tectonic plates, lithosphere underlying the Molucca Sea is subducting into the Sanghie Trench to the west and into the Halmahera Trench to the east. The epicenter of this earthquake is shown by the star.

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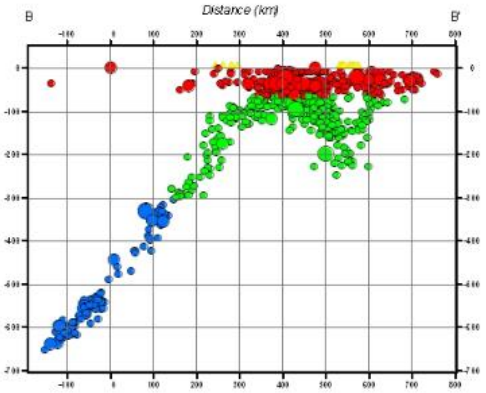
Historical seismicity is plotted in the region of the earthquake. Tectonics in eastern Indonesia are extremely complex. At the location of this earthquake, the Sunda and Philippine Plates are converging in an east-west direction at a rate of approximately 109 mm/yr.

A cross section reveals both deep earthquakes within the subducting Philipine Plate and a pattern of shallow seismicity in the region.



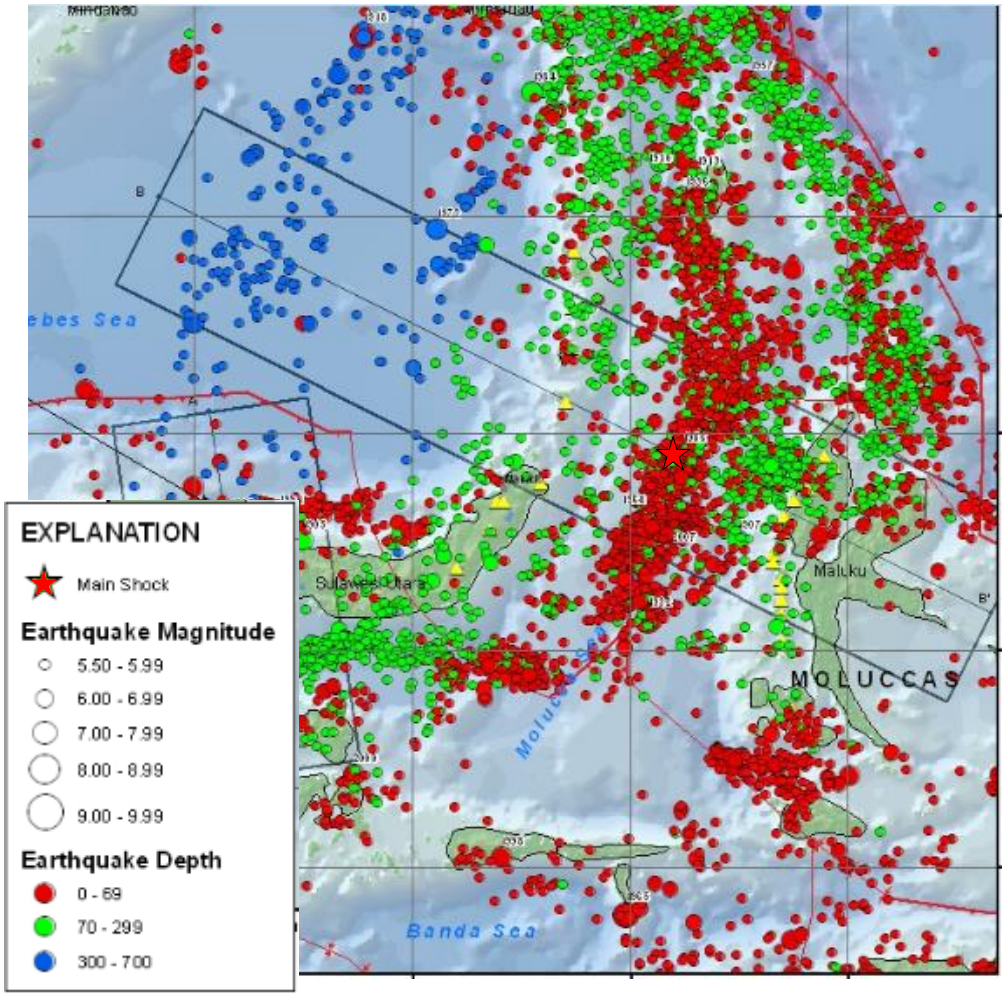


Image courtesy of the US Geological Survey

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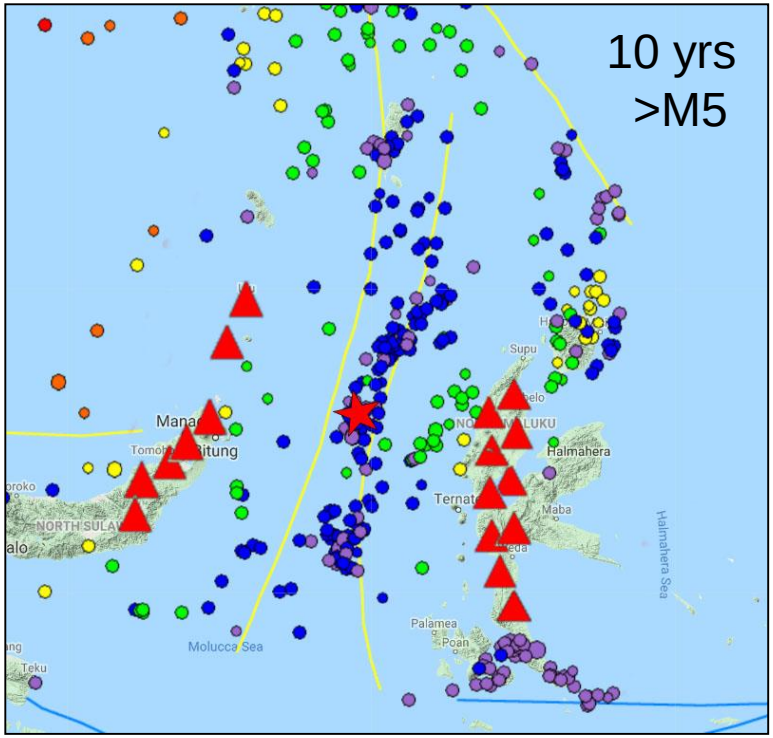
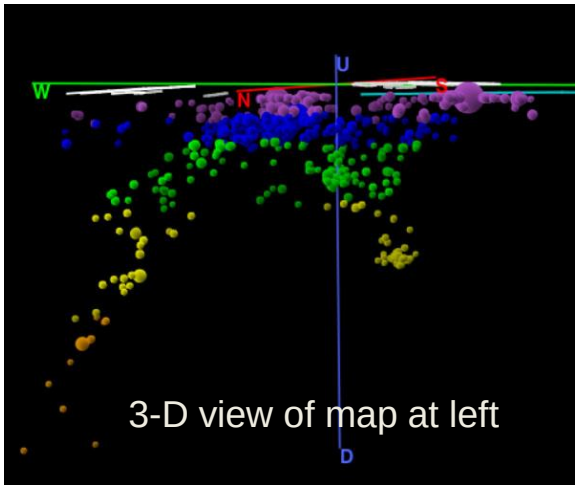
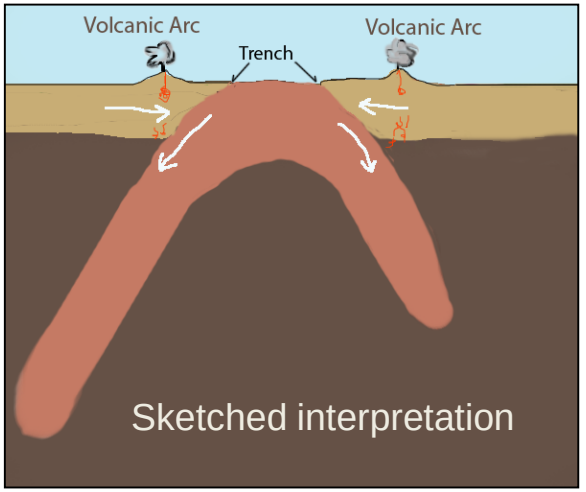
A closer look at the 3D view through this earthquake reveals that it occurred between two subduction zones dipping in opposite directions. This is consistent with the east - west interplate and intraplate convergence across the region. The 3D view and interpreted tectonic cartoon are shown on the right.



Map from the IRIS *Interactive Earthquake Browser* showing 10 years of M>5 earthquakes. Volcanic arcs shown by red triangles. Yellow lines are convergent plate boundaries.





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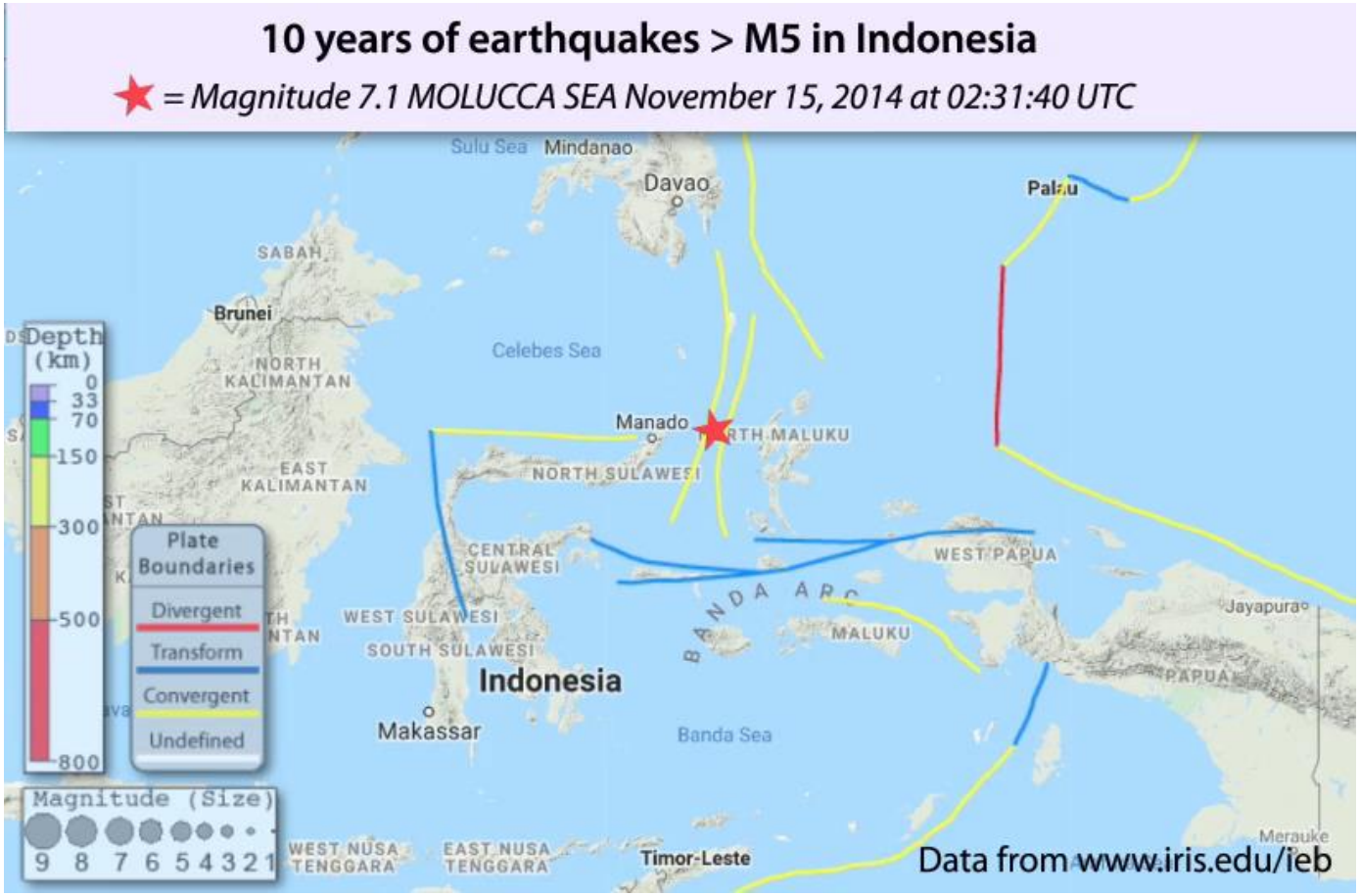
An animation of the map on the previous slide showing 10 years of M>5 earthquakes. Yellow lines are convergent plate boundaries.



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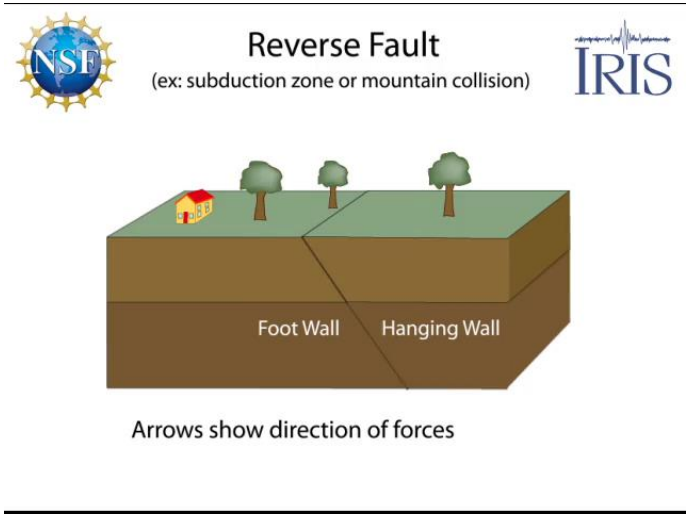
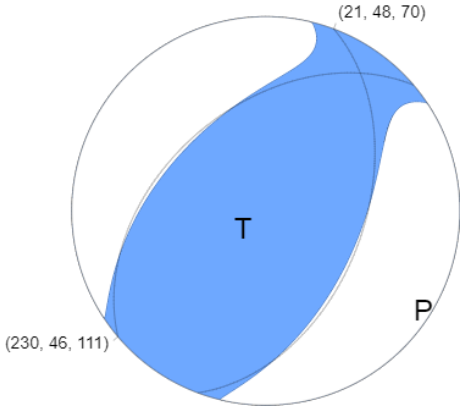
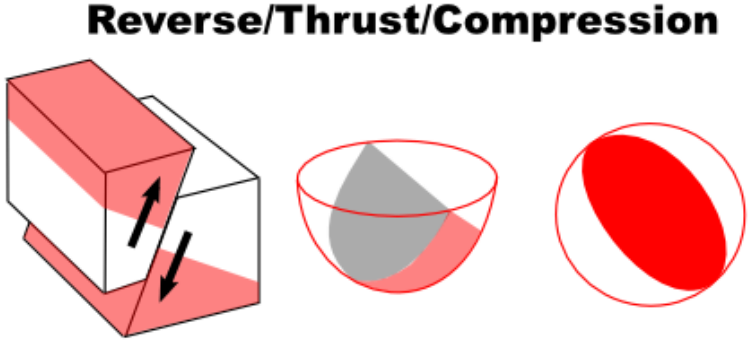
The focal mechanism is how seismologists plot the 3-D stress orientations of an earthquake. Because an earthquake occurs as slip on a fault, it generates primary waves in quadrants where the first pulse is compressional (shaded) and quadrants where the first pulse is extensional (white). The orientation of these quadrants determined from recorded seismic waves identifies the type of fault that produced the earthquake.





W-phase Moment Tensor Solution

Images courtesy of the U.S. Geological Survey



The tension axis (T) reflects the minimum compressive stress direction. The pressure axis (P) reflects the maximum compressive stress direction.

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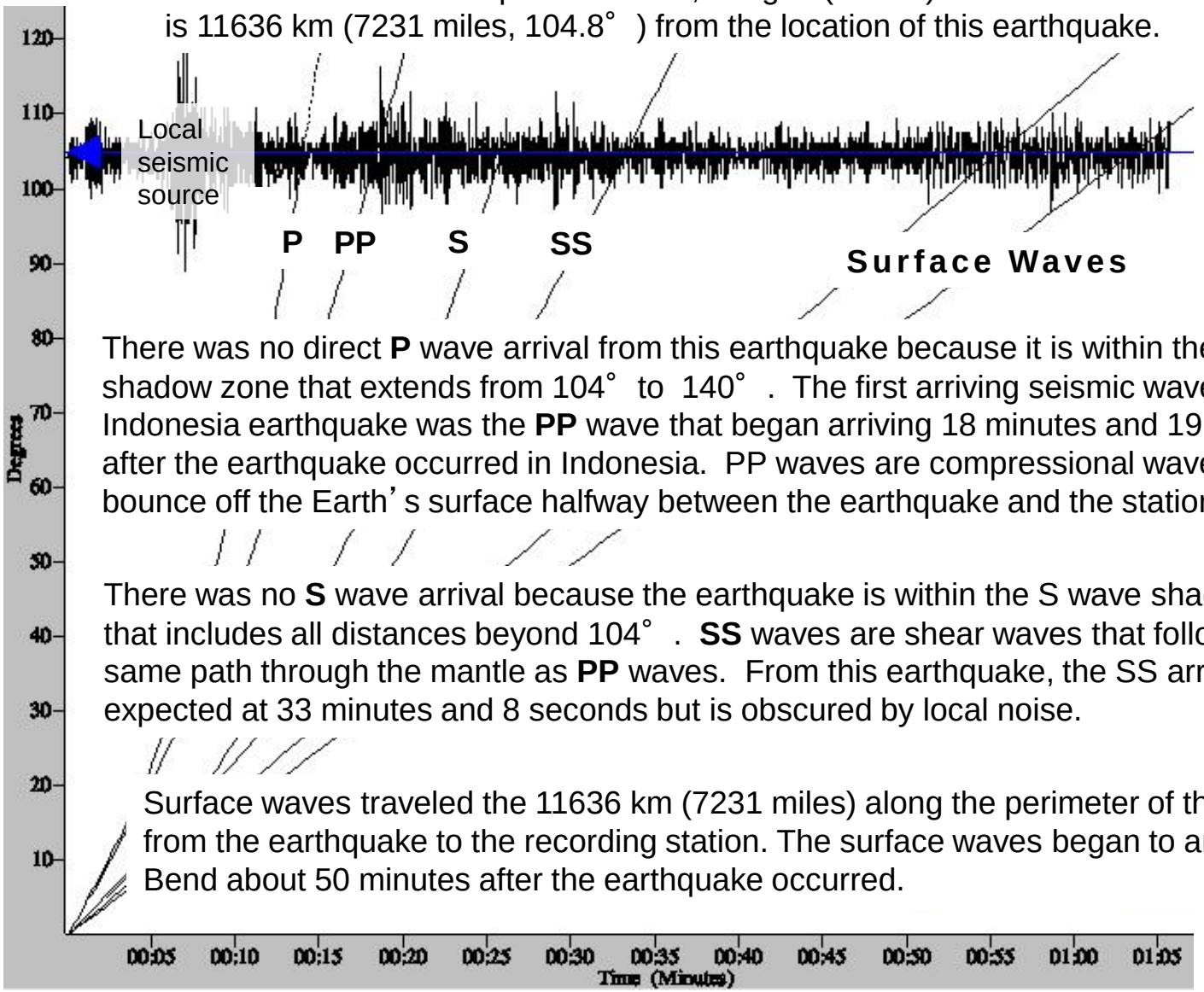
The record of the earthquake in Bend, Oregon (BNOR) is illustrated below. Bend is 11636 km (7231 miles, 104.8˚) from the location of this earthquake.



There was no direct **P** wave arrival from this earthquake because it is within the P wave shadow zone that extends from 104˚ to 140˚. The first arriving seismic wave from the Indonesia earthquake was the **PP** wave that began arriving 18 minutes and 19 seconds after the earthquake occurred in Indonesia. PP waves are compressional waves that bounce off the Earth's surface halfway between the earthquake and the station.

There was no **S** wave arrival because the earthquake is within the S wave shadow zone that includes all distances beyond 104˚. **SS** waves are shear waves that followed the same path through the mantle as **PP** waves. From this earthquake, the SS arrival is expected at 33 minutes and 8 seconds but is obscured by local noise.

Surface waves traveled the 11636 km (7231 miles) along the perimeter of the Earth from the earthquake to the recording station. The surface waves began to arrive in Bend about 50 minutes after the earthquake occurred.

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