Magnitude 7.3 INDONESIA
Sunday, July 14, 2019 at 09:10:50 UTC

A magnitude 7.3 earthquake shook the Moluccas islands on Sunday 165.9 km (103.1 mi) SSE of Ternate, Indonesia at a depth of 10 km (6.2 miles).

Early reports indicate damage to houses in eastern Indonesia but no injuries or deaths.

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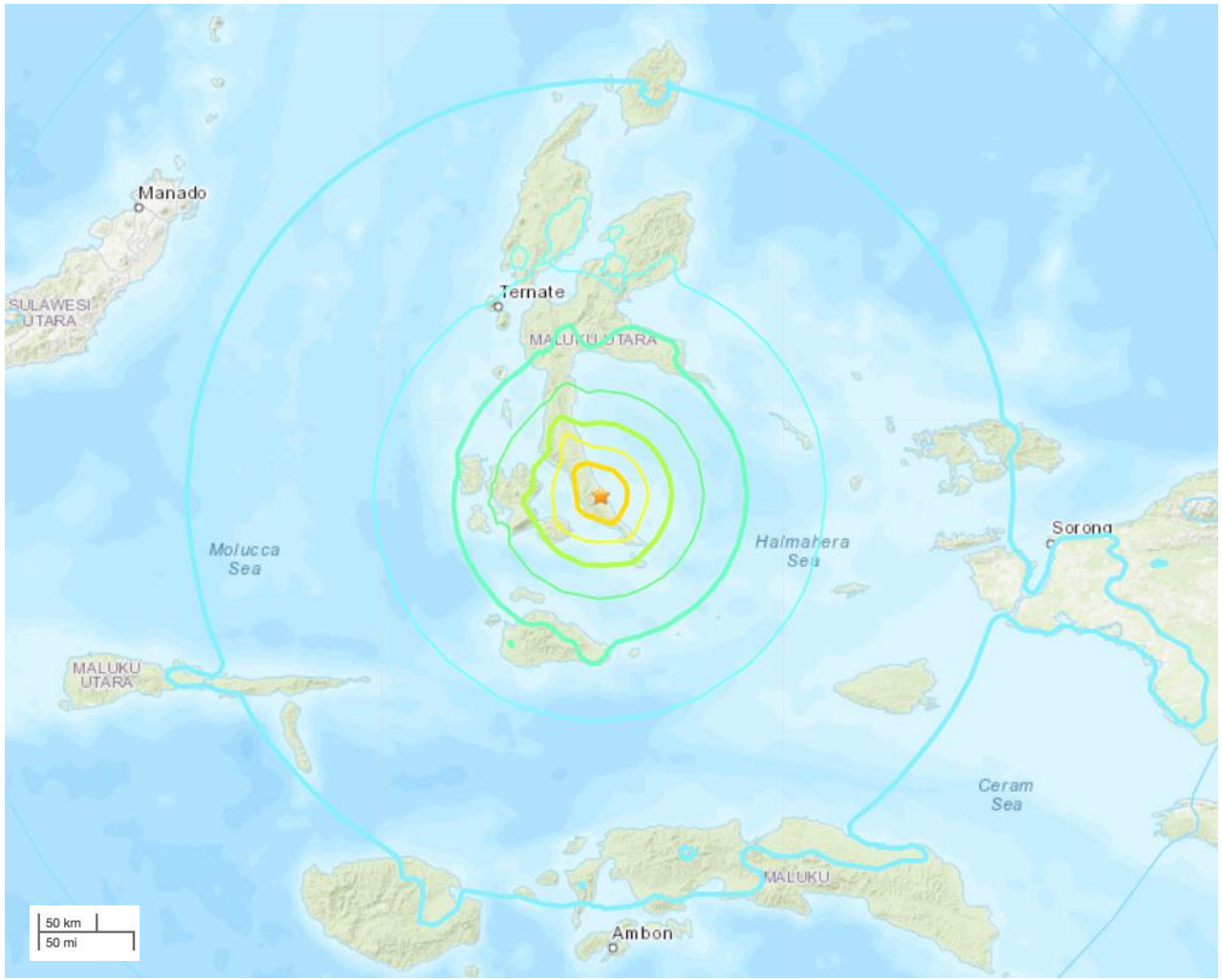
The Modified-Mercalli Intensity (MMI) scale is a twelve-stage scale, from I to XII, that indicates the severity of ground shaking.

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 7.3 Earthquake

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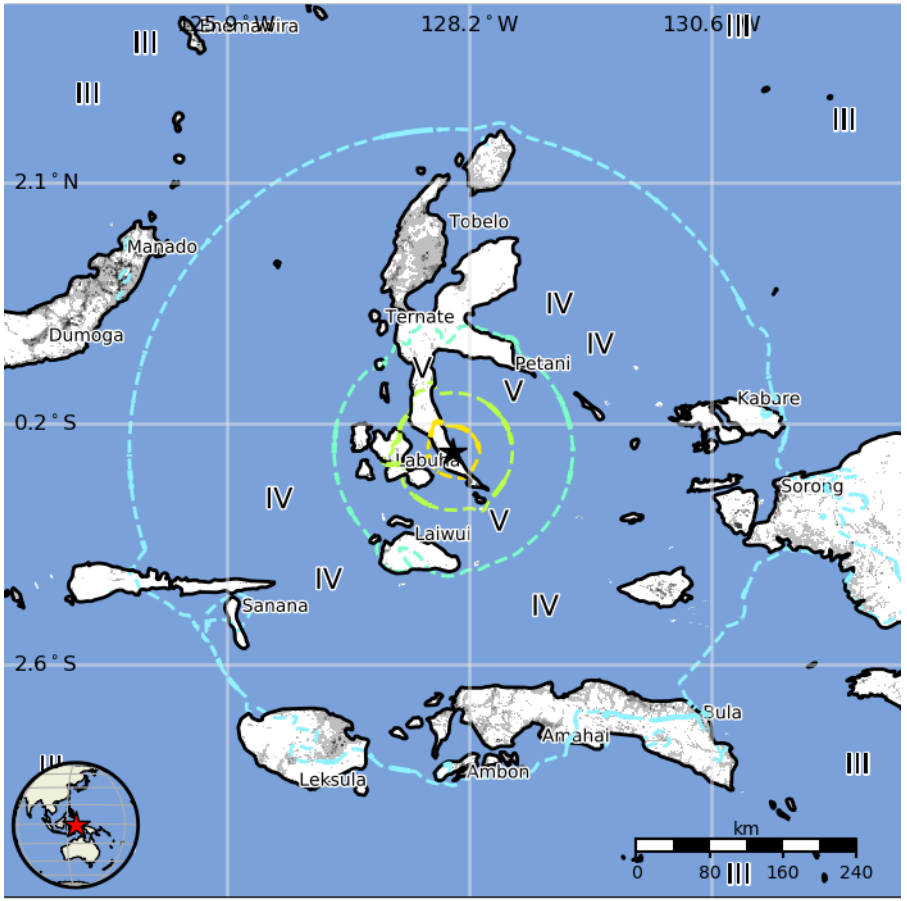
USGS PAGER
Population Exposed to Earthquake Shaking

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

10,000 people were exposed to very strong shaking from this earthquake.

I	Not Felt	0 k*
II-III	Weak	1,521 k*
IV	Light	3,364 k
V	Moderate	180 k
VI	Strong	58 k
VII	Very Strong	10 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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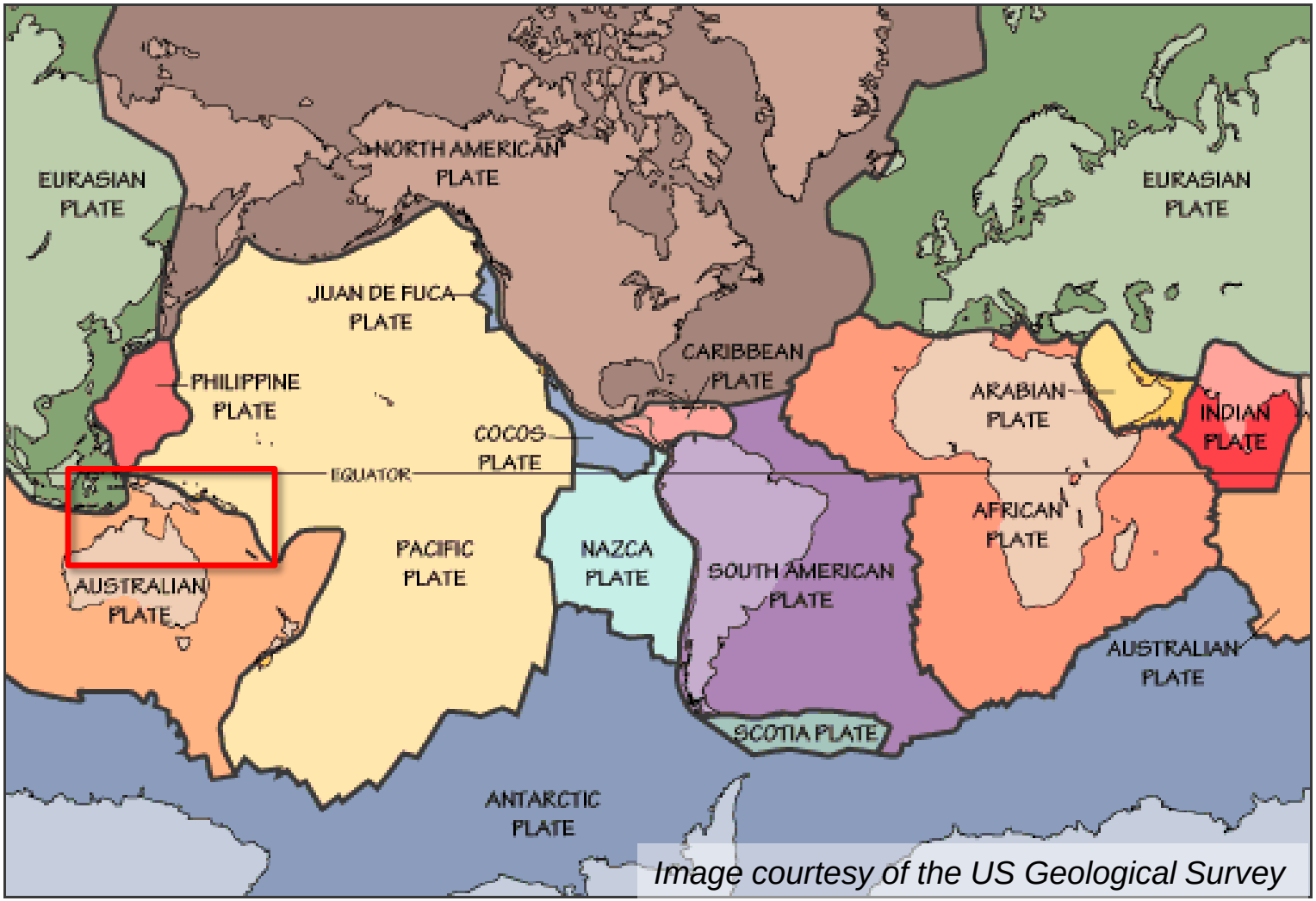

Image courtesy of the US Geological Survey

The Pacific, Philippine, Eurasian and Australian Plates meet in a complex arrangement of subduction zones in the western Pacific Ocean. In detail, there are numerous microplates (fragments of larger plates) with convergent, divergent, and transform (strike-slip) boundaries between them. The next slide illustrates the tectonics in the area of the red square.

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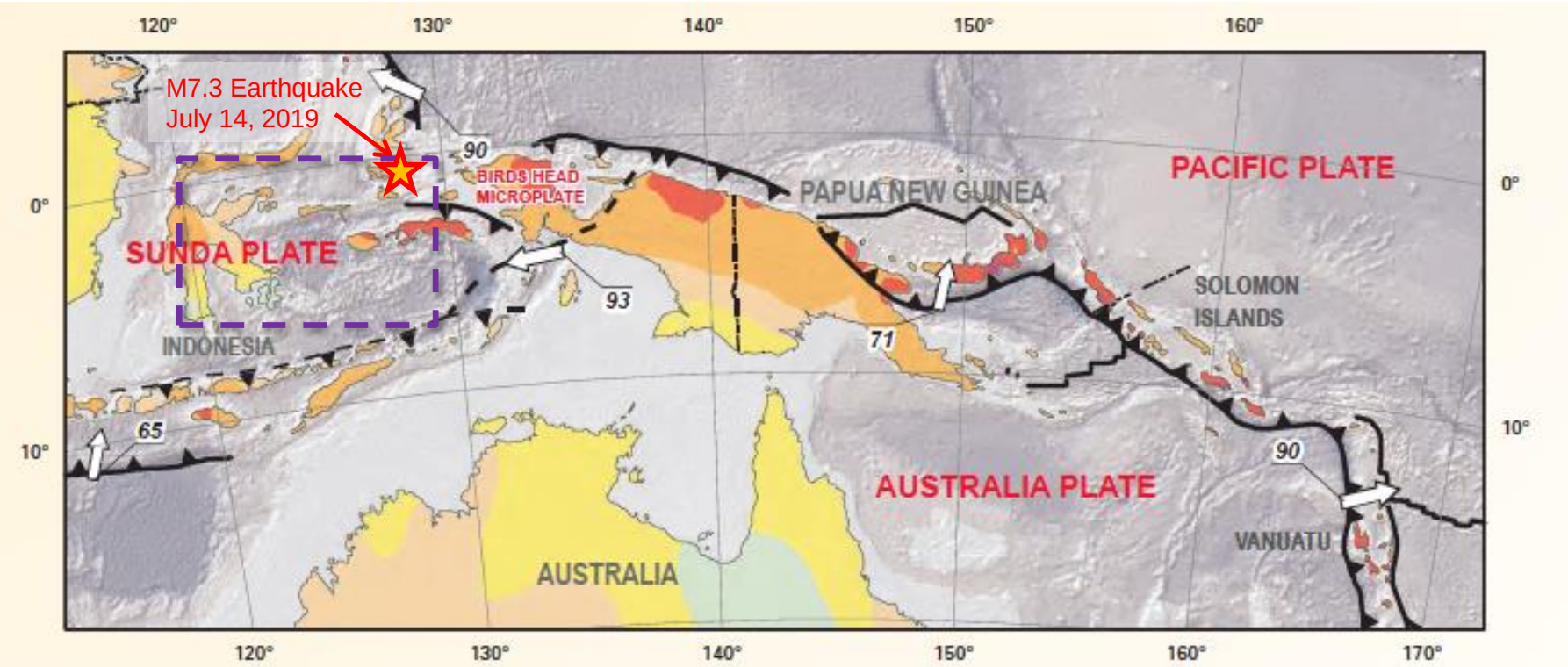

Map from USGS Open-File Report 2010-1083-H *Seismicity of the Earth 1900–2010 New Guinea and Vicinity*

The map above shows plate boundaries between the Sunda, Pacific, and Australia Plates surrounding Papua New Guinea. The Sunda Plate is the southeastern promontory of the Eurasia Plate. Arrows with numbers indicate the relative plate motions across specific boundaries in mm/yr. Black lines with “teeth” are convergent plate boundaries with the teeth on the overriding plate. For example, north of the July 14, 2019 earthquake labeled by the star, the Pacific Plate is subducting beneath the Sunda Plate at 90 mm/yr = 9 cm/yr. Details within the dashed outline are shown on the next slide.

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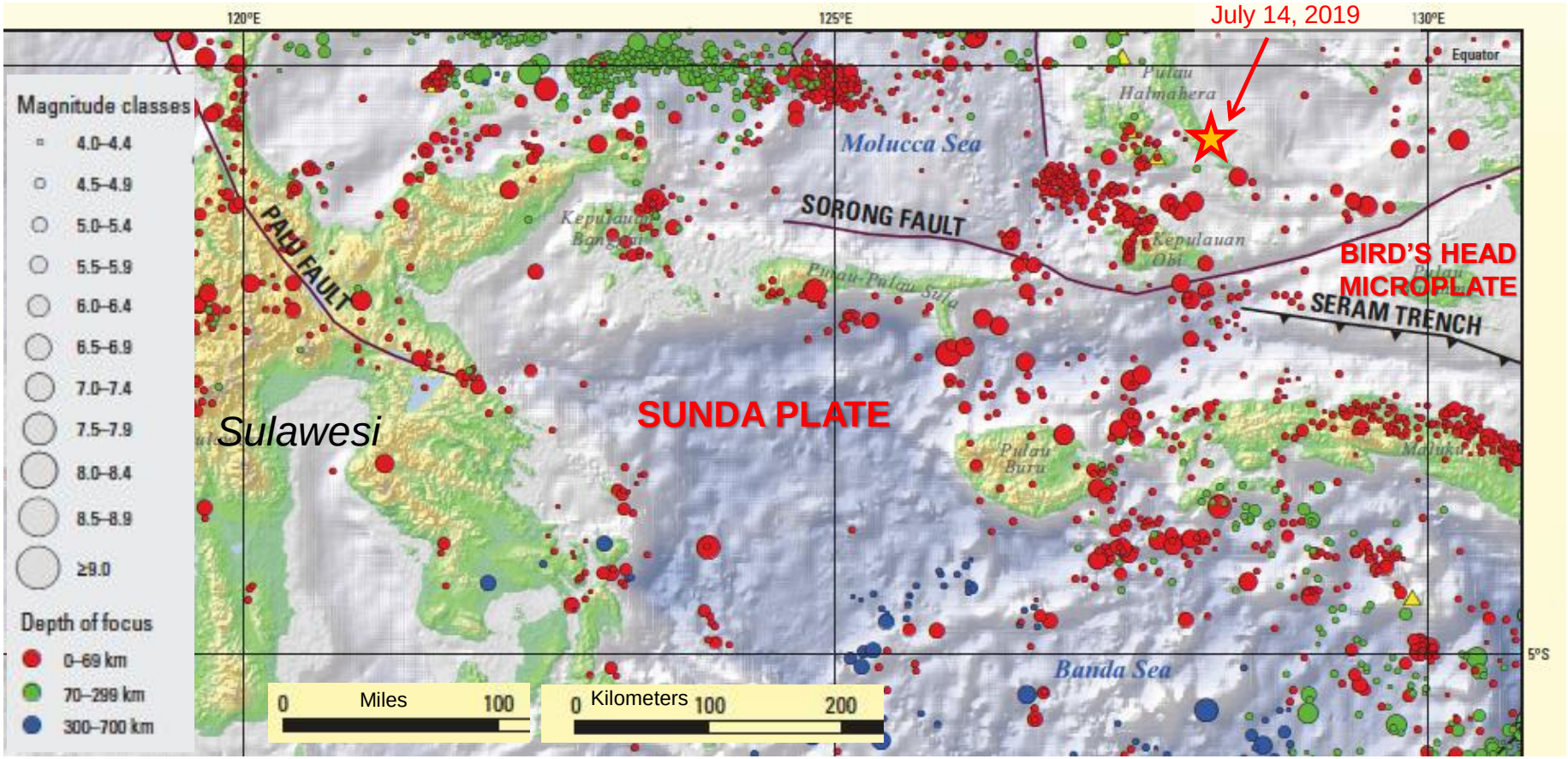

Image courtesy of the US Geological Survey

The Sunda Plate in the Molucca Sea and Banda Sea region is surrounded by and converging with the Pacific and Australia Plates. The Bird's Head microplate on the right edge of the map area is a piece of the Australia Plate that is subducting into the Seram Trench. Earthquakes and mapped faults indicate internal deformation of the Sunda Plate. The July 14, 2019 earthquake most likely occurred on an intraplate strike-slip fault within the Sunda Plate.

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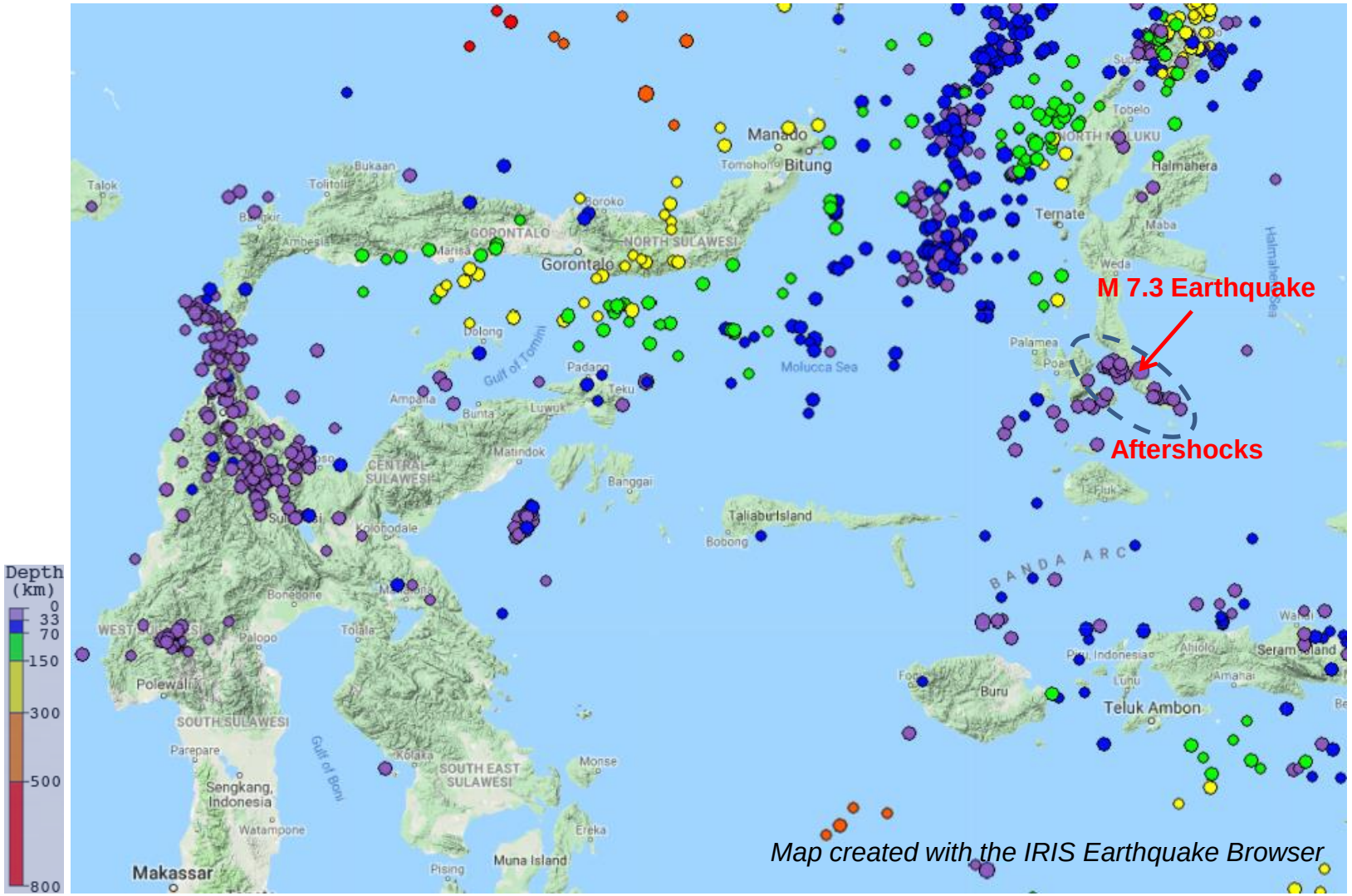

Locations of the July 14, 2019 earthquake and the 1000 most recent earthquakes are shown. Notice the NE – SW distribution of aftershocks that probably indicates the M7.3 mainshock occurred on a NE – SW oriented intraplate strike-slip fault.

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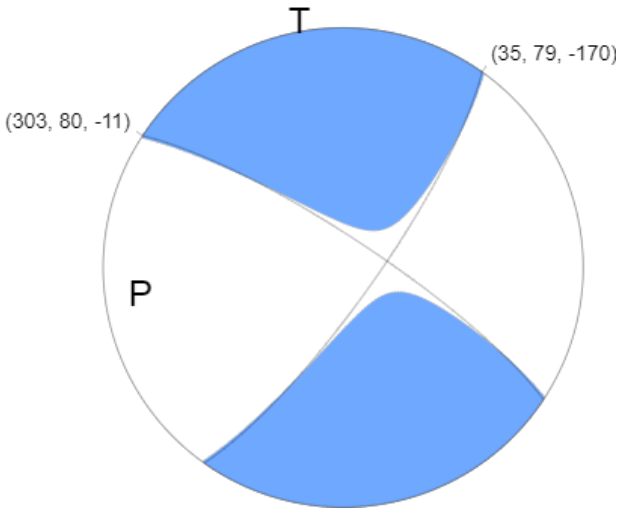
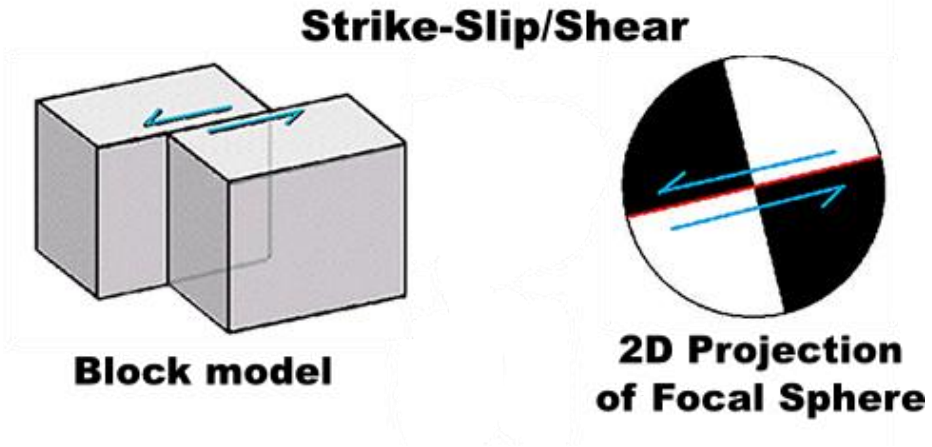
The focal mechanism is how seismologists plot the 3-D stress orientations of an earthquake. Because an earthquake occurs as slip on a fault, it generates primary waves in quadrants where the first pulse is compressional (shaded) and quadrants where the first pulse is extensional (white). The orientation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

The July 14, 2019 earthquake occurred as a result of oblique strike-slip faulting at shallow depth (10 km = 6.2 miles) within the Sunda Plate. Given the NW – SE distribution of aftershocks shown on the next slide, the M7.3 earthquake probably resulted from left-lateral displacement on a NW – SE oriented strike-slip fault.



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.

Images courtesy of the U.S. Geological Survey

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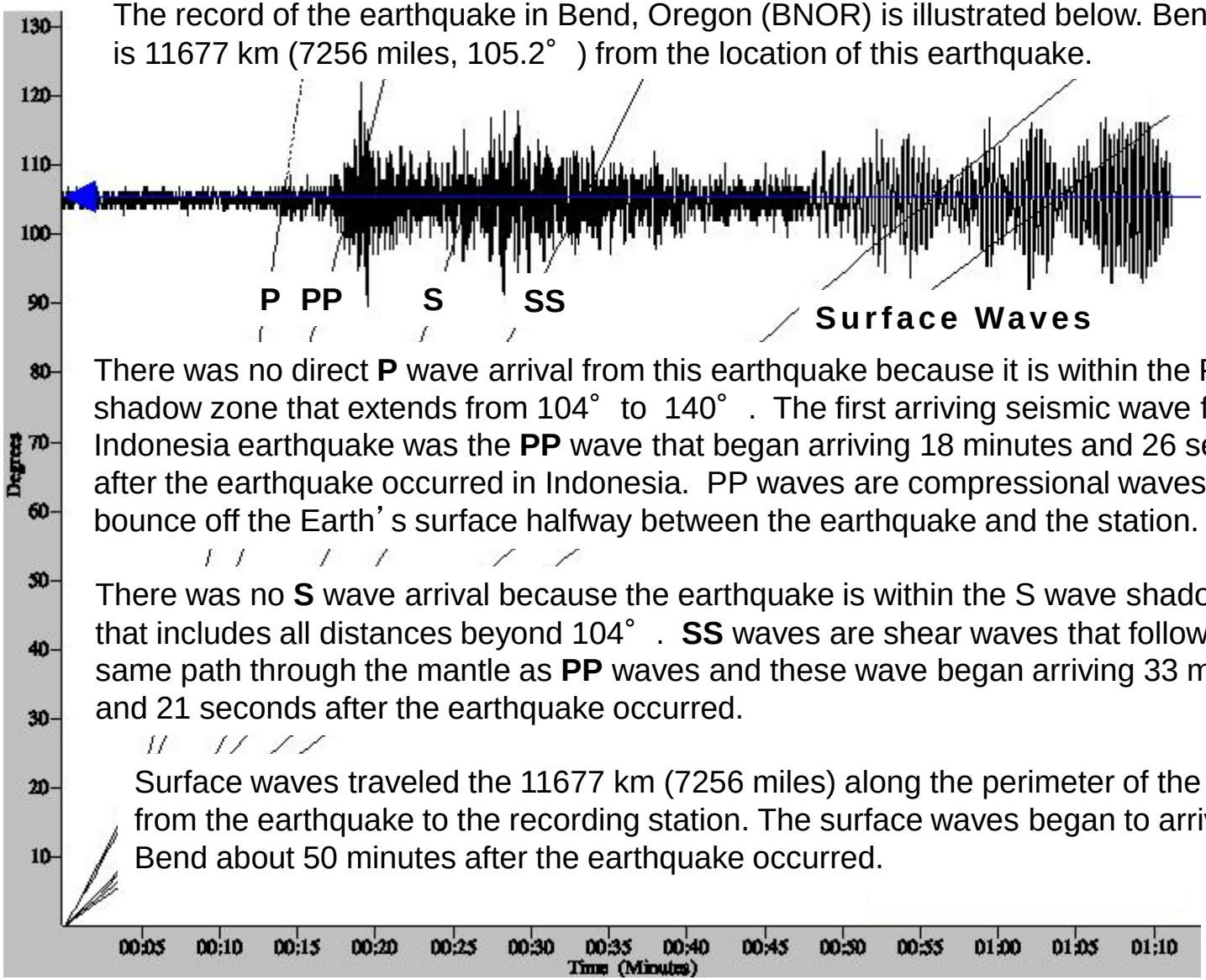
The record of the earthquake in Bend, Oregon (BNOR) is illustrated below. Bend is 11677 km (7256 miles, 105.2˚) from the location of this earthquake.



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 26 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 and these wave began arriving 33 minutes and 21 seconds after the earthquake occurred.

Surface waves traveled the 11677 km (7256 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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