Magnitude 7.4 CHILE

Friday, July 19, 2024 at 01:50:46 UTC

Latitude 23.047° S
Longitude 67.782°W
Depth 117 km

A magnitude 7.4 earthquake occurred near Atacama, Chile on Thursday evening local time at a depth of 117 kilometers (72 miles).

The earthquake occurred near the tripoint (geographical point at which the boundaries of three countries meet) border of Chile, Argentina, and Bolivia.

There were no immediate reports of injuries and only minor damage. Additionally, the Pacific Tsunami Warning Center indicated there was no risk of a tsunami from the earthquake.

Damage is likely to be limited due to the sparsely populated region directly above the epicenter, as well as the relatively deep hypocenter of the earthquake.

Zapaleri is a volcano whose summit is the tripoint of the borders of Argentina, Bolivia and Chile. It is a major source of obsidian.

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A small landslide about 257 km (160 miles) away from the earthquake's epicenter caused rocks to fall on a coastal highway near the town of Tocopilla.

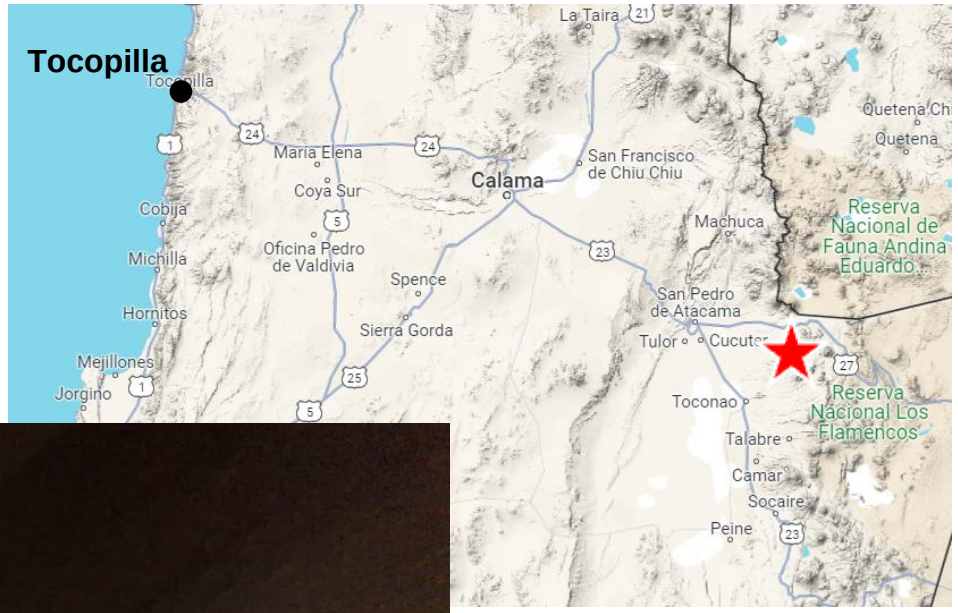

Photo via X @HombredeRadio

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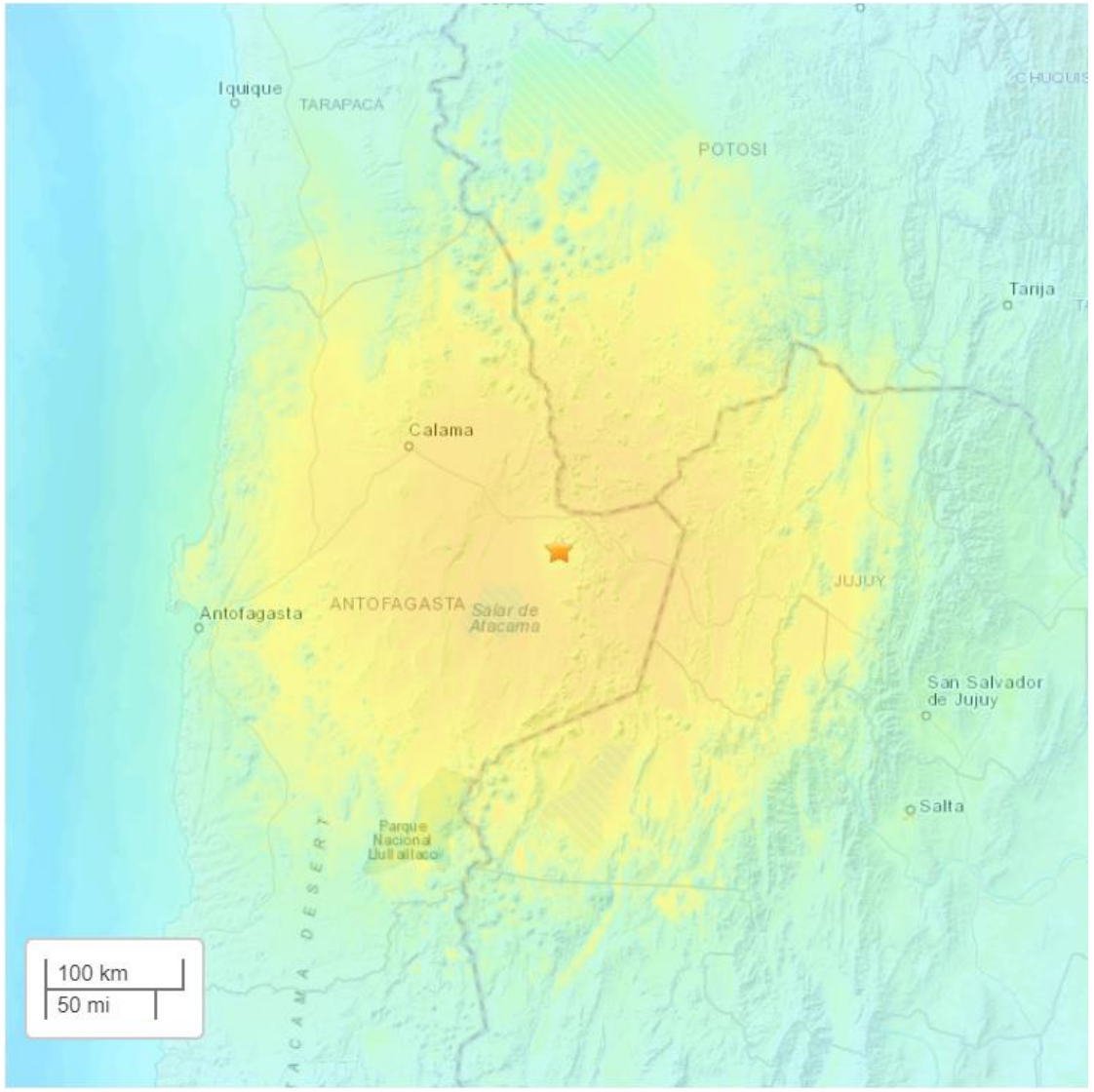
The Modified-Mercalli Intensity (MMI) scale is a ten-stage scale, from I to X, that indicates the severity of ground shaking.

Intensity is based on observed effects and is variable over the area affected by the earthquake and 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 7.4 Earthquake

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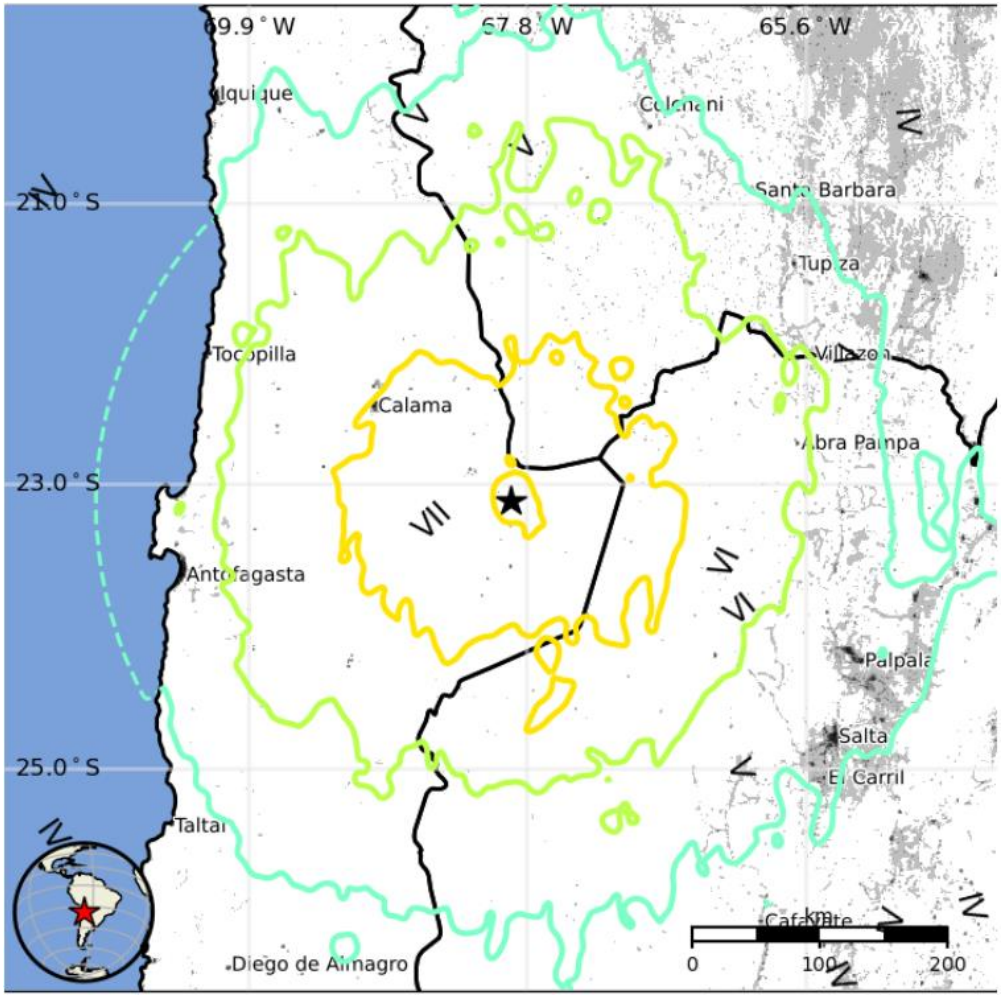
The USGS PAGER map shows the population exposed to different Modified Mercalli Intensity (MMI) levels. The USGS estimates that approximately 184,000 people felt very strong shaking from this earthquake.

MMI	Shaking	Population
I	Not Felt	0 k*
II-III	Weak	0 k*
IV	Light	1,275 k*
V	Moderate	2,532 k
VI	Strong	161 k
VII	Very Strong	184 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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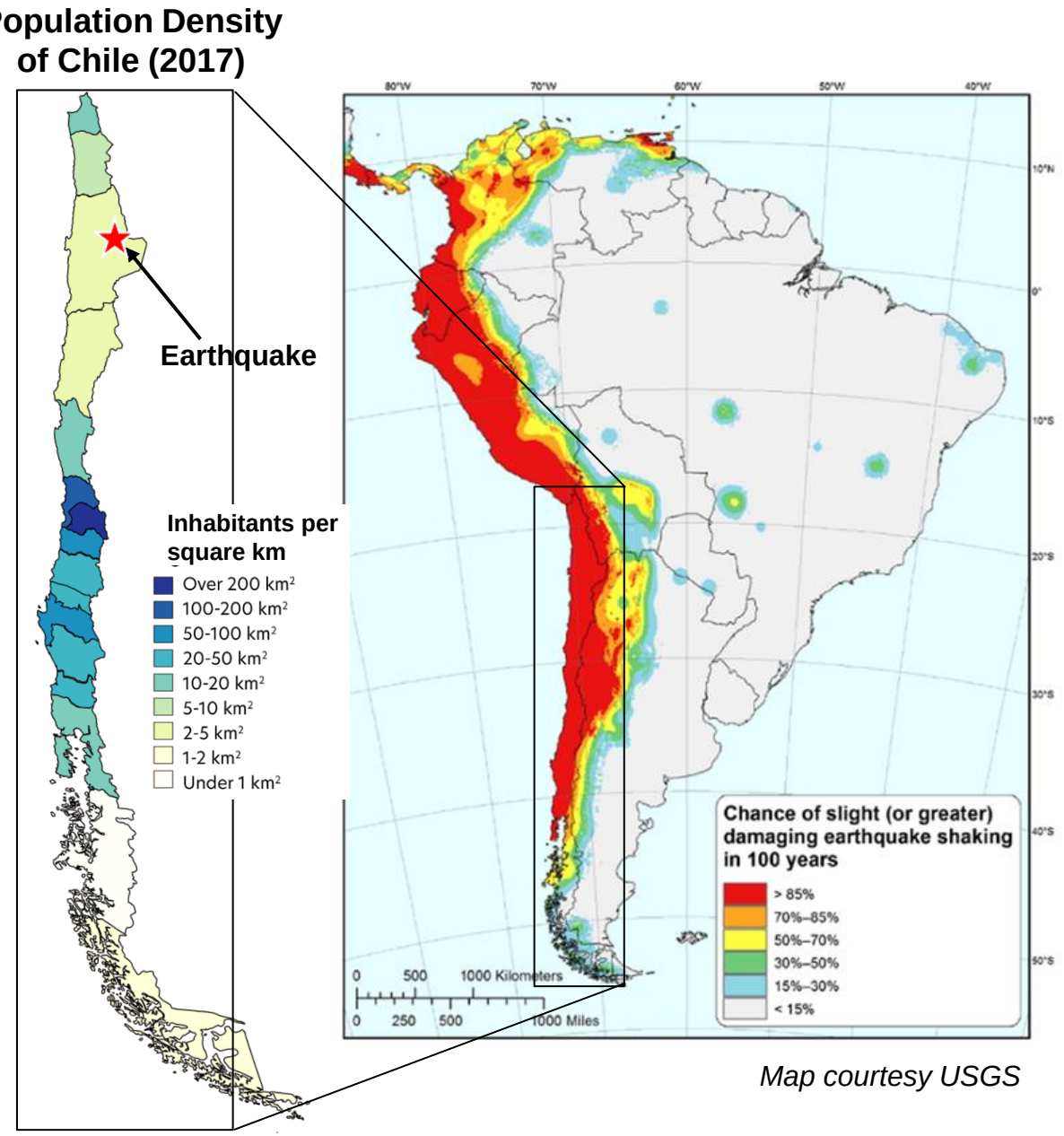
Over 160 million people (around a third of the total population of South America) live in areas with significantly elevated seismic hazard. The northern and western portions of the continent commonly experience earthquakes related to subduction and crustal faulting.

The July 19 earthquake occurred in the Atacama Desert region of Chile, a relatively sparsely populated area. The large population centers in the center of the country were thankfully not impacted by the earthquake.



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Map courtesy USGS

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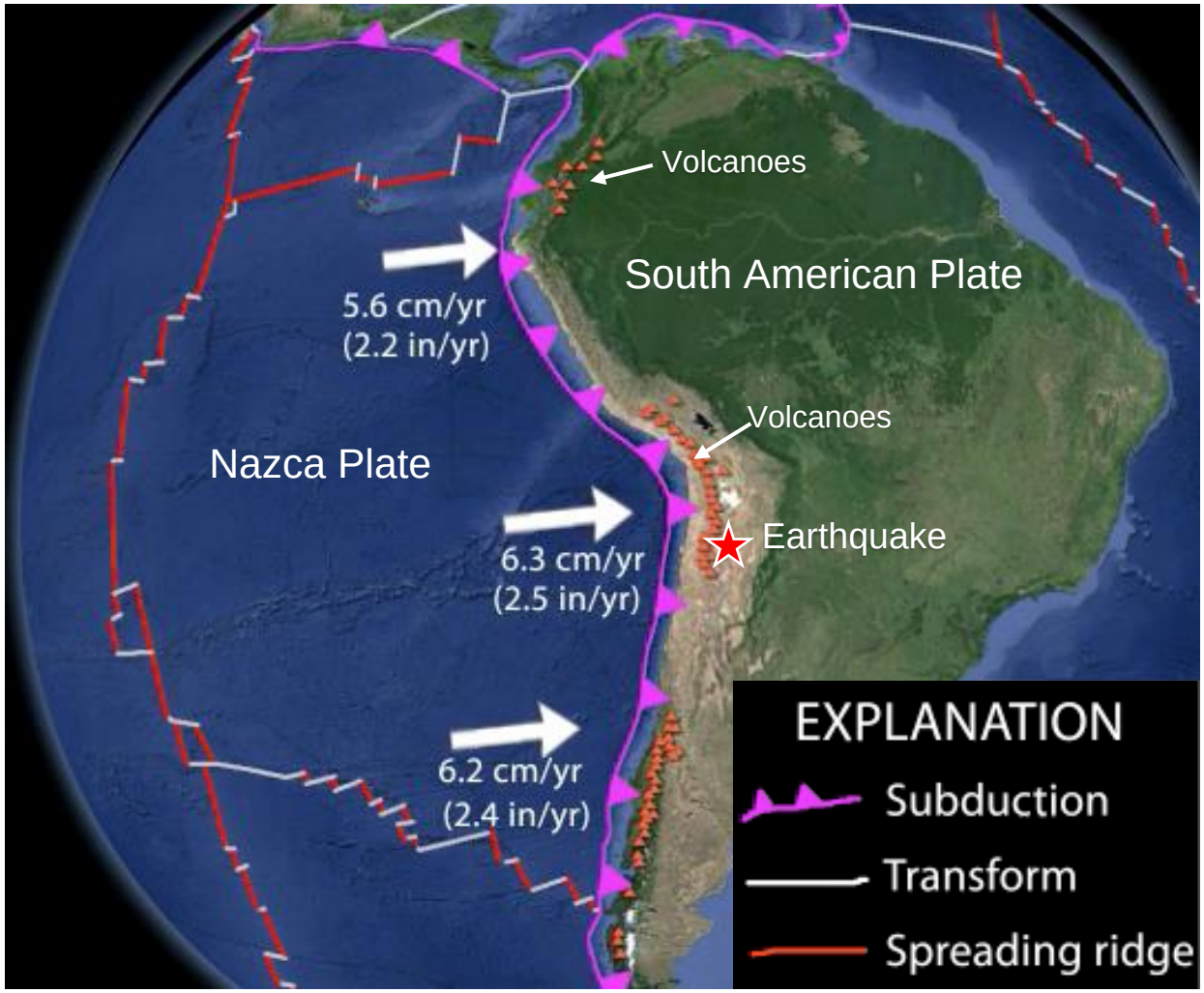
This illustration shows the rate and direction of motion of the Nazca Plate with respect to the South American Plate. Locations of active Andean volcanoes are shown by orange triangles.

The July 19th earthquake is shown by the red star. At this location, the Nazca Plate subducts beneath the South America Plate at a velocity of about 6.3 cm/yr.



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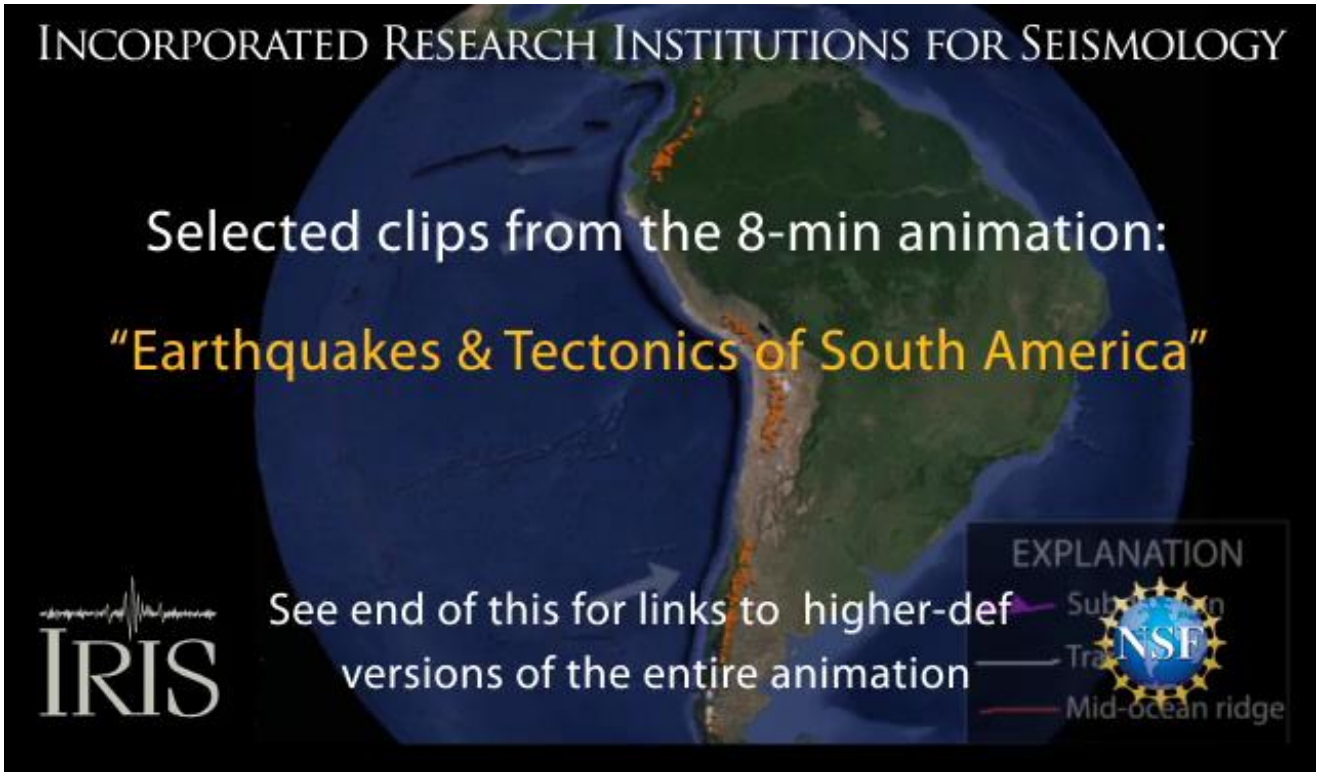
At the location of the July 19 earthquake, the oceanic Nazca Plate moves east-northeast relative to the South American Plate, subducting at the Peru-Chile Trench west of the Chilean coast and sinking into the mantle beneath South America. This earthquake occurred at an intermediate-depth of 117 km, where earthquakes occur within the subducting plate rather than along the shallow plate interface between subducting and overriding tectonic plates.



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

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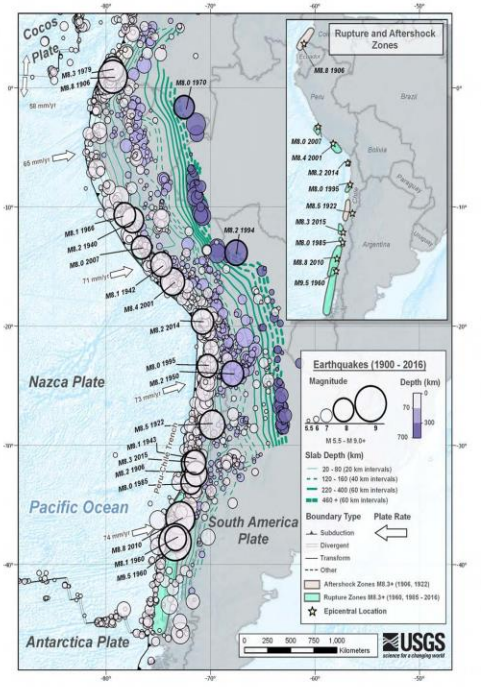
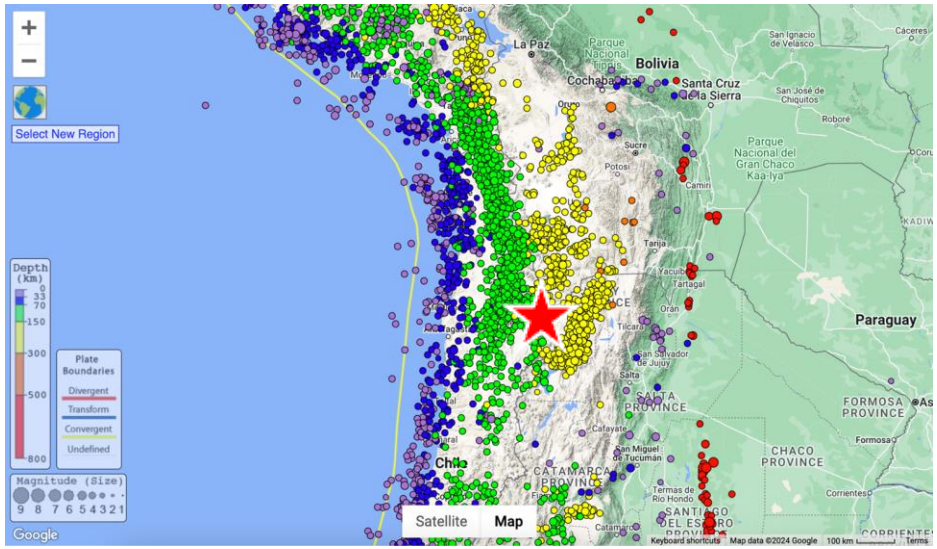
A look at historical seismicity in this area shows many earthquakes, with a clear deepening trend (purple/blue to yellow/red) as you move inland (east) from the Pacific coastline of South America.

Earthquakes at depths between 70-300 km are known as “intermediate depth” earthquakes and are common in this part of South America, as shown by the large number of yellow epicenters on the lower map.

Intermediate-depth earthquakes in this region reflect deformation within the Nazca Plate where it bends as it subducts beneath the South American Plate.



USGS historical seismicity map of South America



Historical seismicity colored by depth, with epicenter (red star) from Interactive Earthquake Browser

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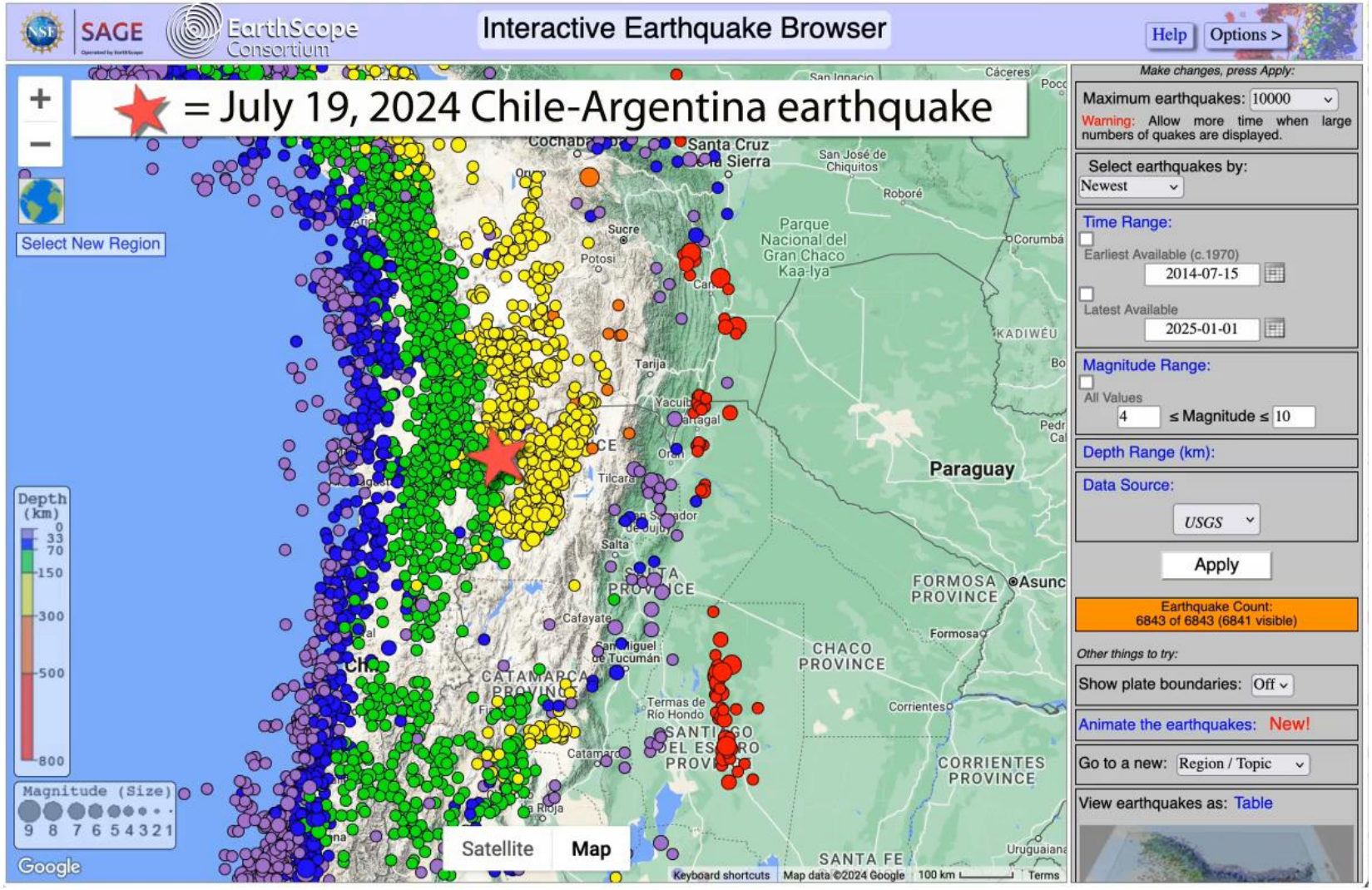
Ten years of regional earthquakes and a 3D cross-section of the seismicity animated.



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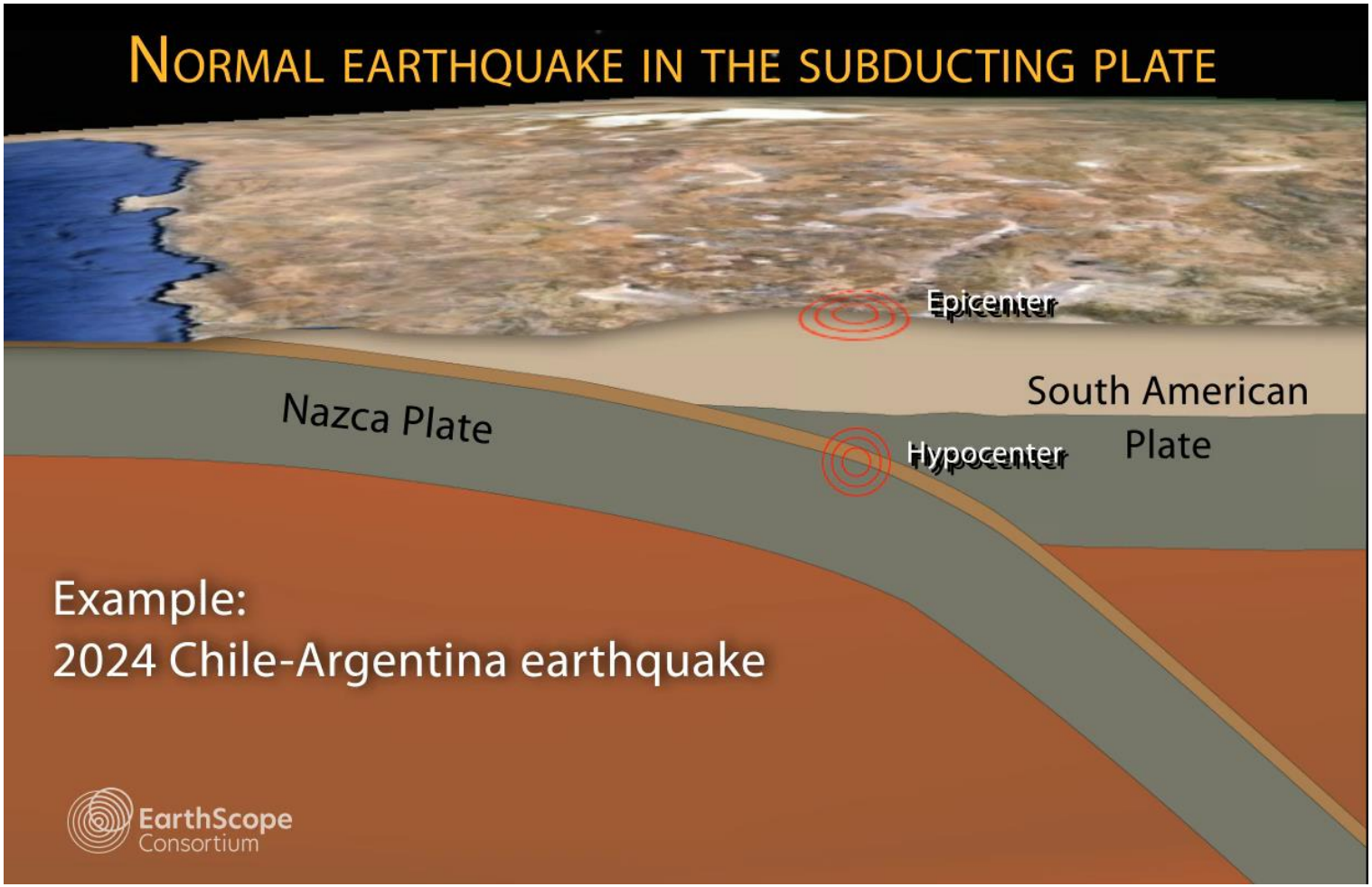
An animation exploring the stresses within the subducting plate, illustrating the dynamic processes and deformation patterns associated with tectonic activity.



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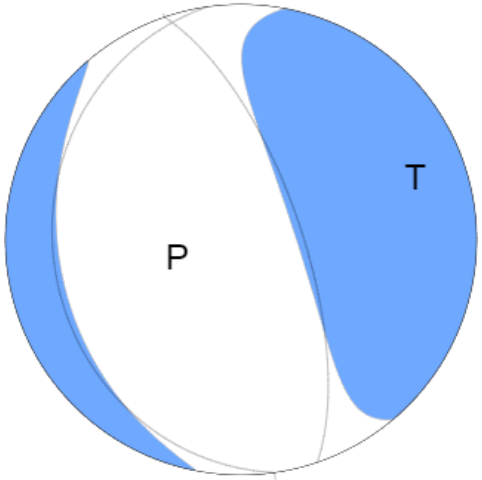
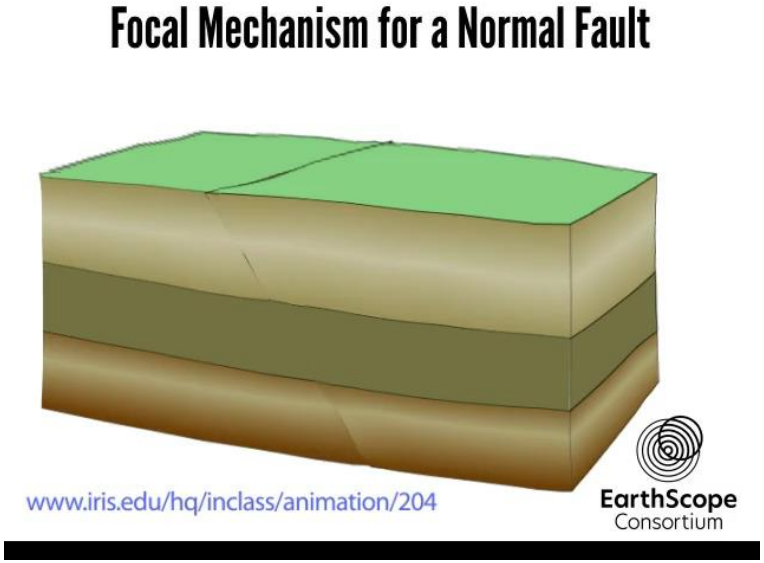
The focal mechanism is how seismologists plot the 3-D stress orientations of an earthquake. Because an earthquake occurs as slip on a fault, it generates primary (P) waves in quadrants where the first pulse is compressional (shaded) and quadrants where the first pulse is extensional (white).

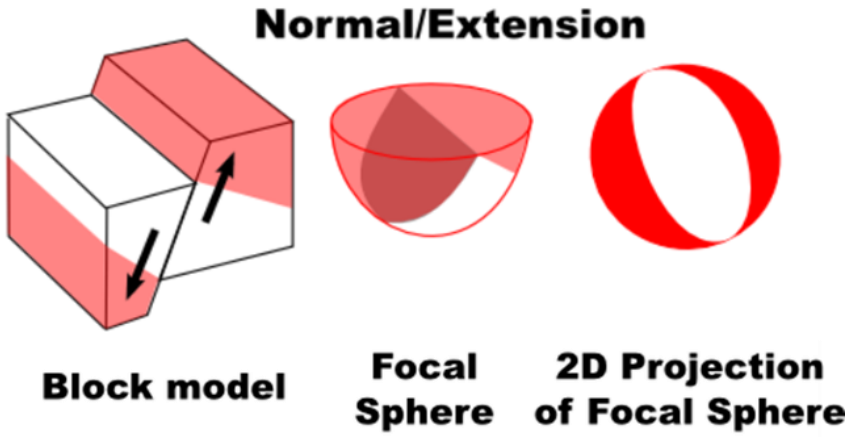
The orientation of these quadrants determined from recorded seismic waves determines the type of fault that produced the earthquake.



USGS 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.





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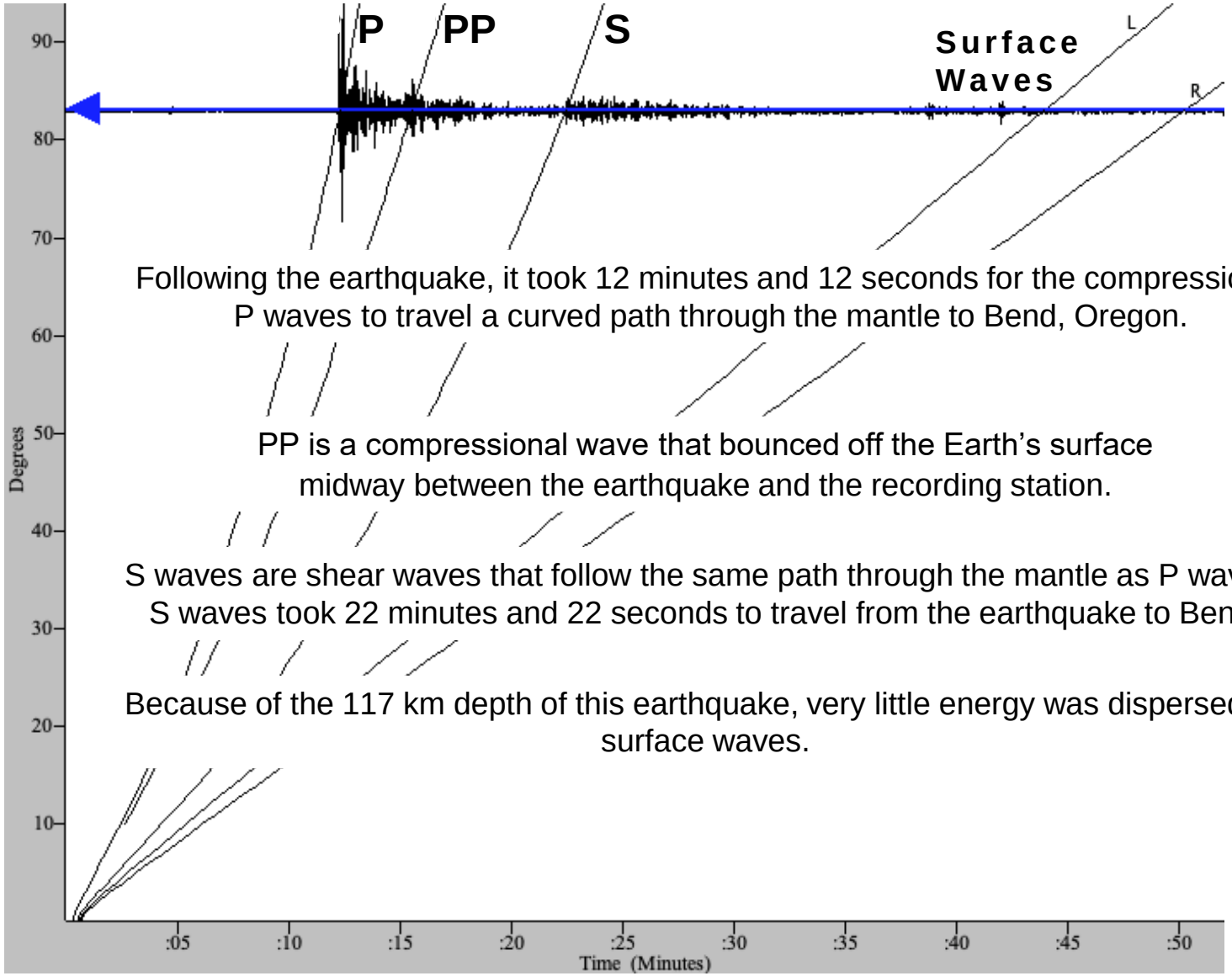
The record of the earthquake in Bend, Oregon (BNOR) is illustrated below.
Bend is 9234 km (5738 miles, 83.2˚) from the location of this earthquake.



Following the earthquake, it took 12 minutes and 12 seconds for the compressional P waves to travel a curved path through the mantle to Bend, Oregon.

PP is a compressional wave that bounced off the Earth's surface midway between the earthquake and the recording station.

S waves are shear waves that follow the same path through the mantle as P waves. S waves took 22 minutes and 22 seconds to travel from the earthquake to Bend.

Because of the 117 km depth of this earthquake, very little energy was dispersed as surface waves.

Teachable Moments are a service of

The EarthScope Consortium
and
The University of Portland

Please send feedback to tammy.bravo@earthscope.org

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