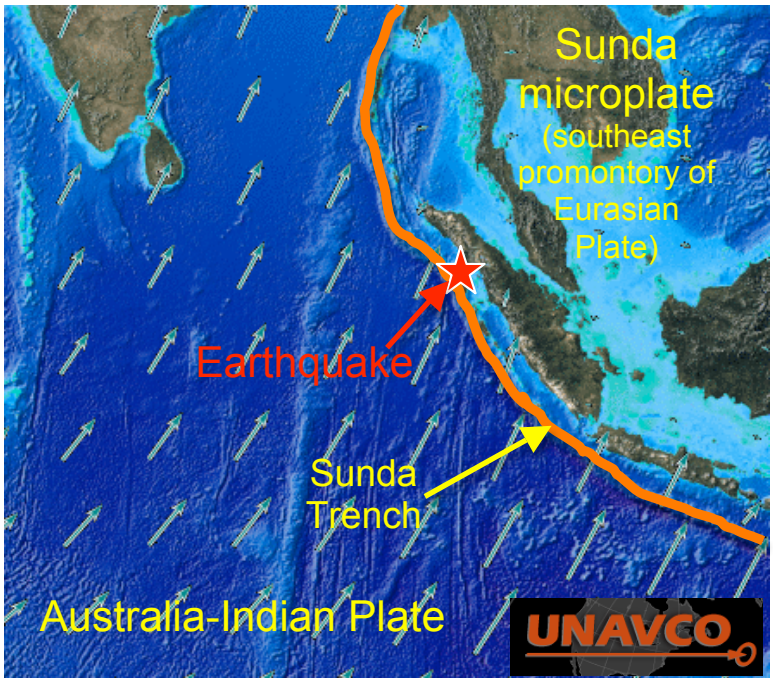
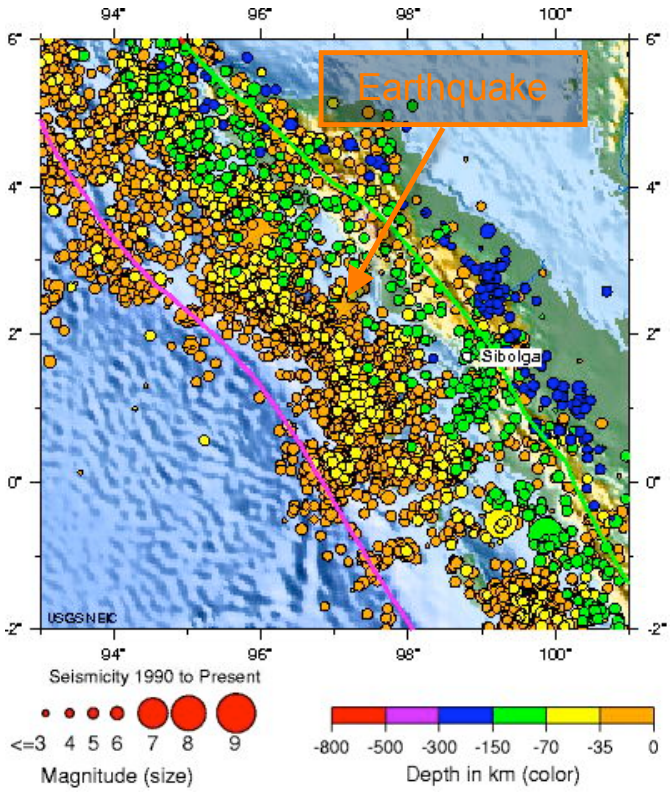
Major 7.7 Earthquake off the West Coast of Northern Sumatra
Tuesday, April 6, 2010 at 22:15:02 UTC
3:15:02 PM Pacific Daylight Time
Epicenter: Latitude 2.360°N, 97.132°E. Depth: 31 kilometers.

As determined by the US Geological Survey National Earthquake Information Center (NEIC), a major earthquake occurred Tuesday afternoon Pacific Daylight Time 205 km (125 miles) west-northwest of Sibolga, Sumatra, Indonesia. The epicenter of the earthquake is indicated by the red star on left-side map below while the orange line shows the surface trace of the boundary between the Australia – Indian Plate and the Sunda microplate (= southeast promontory of Eurasian Plate). The map on the right below shows historic earthquake activity near the epicenter (orange star) from 1990 to present. As the Australia – Indian Plate subducts below the Sunda microplate at a velocity of about 60 mm/yr (6 cm/yr), earthquake depths increase from southwest to northeast across this plate boundary. The earthquake of April 6, 2010 nicely fits the pattern of depths for earthquakes that occur on the subsurface interface between the Australia – Indian Plate and the Sunda microplate. According to the Pacific Tsunami Warning Center, a local tsunami watch was issued for Indonesia but was later cancelled. No reports of damage, deaths, or injuries are available at this time.

It is important to remember that a ~1200 km length of the subduction zone boundary between the Australia – Indian and the Sunda microplate ruptured from northern Sumatra to the Andaman Islands in the great magnitude (M) 9.2 earthquake of December 26, 2004. That great earthquake produced the Indian Ocean tsunami that killed 230,000 people in countries around the Indian Ocean. On March 28, 2005, a M8.6 earthquake occurred off the coast of northern Sumatra killing 1313 people. The largest earthquake of 2007 was a M8.5 event off the coast of southern Sumatra. The deadliest earthquake of 2009 was a M7.5 earthquake on September 30 in southern Sumatra that killed 1117 people. All of these earthquakes on the subduction zone plate boundary between Australia – Indian and the Sunda microplate may be aftershocks of the December 26, 2004 great earthquake.





The record of the Sumatra earthquake on the University of Portland seismometer is illustrated below. Portland is about 13,408 km (~8331 miles, 120.79 degrees) from the location of this earthquake. Body waves travel through Earth's mantle from the earthquake to a distant station along paths that curve upwards because the velocity of seismic waves generally increases with depth in the mantle. However, direct P and S waves cannot travel to stations more than epicentral distance $\Delta > 103°$ because of the large decrease in wave velocities across the boundary between the mantle and the liquid outer core. (Epicentral distance, Δ, 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.) There is a "shadow zone" for direct P waves in the range $103° < \Delta < 143°$. The S-wave shadow zone exists for $\Delta > 103°$ because the liquid outer core blocks S waves that cannot travel through liquids. The wave labeled PP is a compressive wave that traveled through Earth's mantle and bounced midway between the epicenter and Portland; SS is a shear wave that also bounced midway between the epicenter and Portland. It took about 20 minutes 15 seconds for the PP waves and 36 minutes 44 seconds for the SS waves to travel from the earthquake to Portland. The (Love and Rayleigh) surface waves traveled from the earthquake to Portland around the perimeter of the Earth. Because the distance around the perimeter is longer than the distance through Earth's mantle and the speed of surface waves is slower than body waves, surface waves did not arrive in Portland until 51 minutes 6 seconds after the earthquake occurred beneath Sumatra.