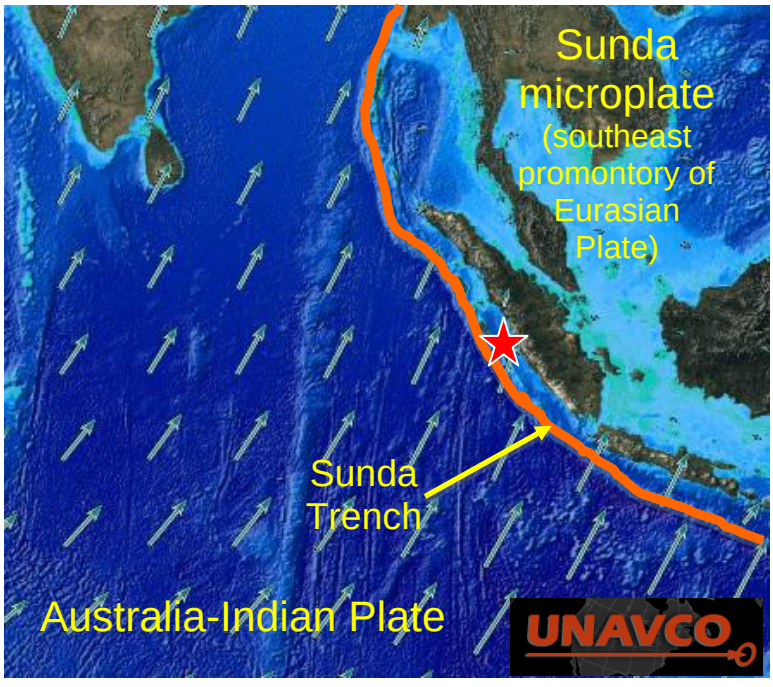
Major 7.7 Earthquake Near West Coast of Sumatra
Monday, October 25, 2010 at 14:42:22 UTC (7:42:22 AM PDT)
Epicenter: Latitude 3.484°S, 100.114°E. Depth: 20.6 kilometers.

As determined by the US Geological Survey National Earthquake Information Center (NEIC), a major earthquake occurred Monday morning Pacific Daylight Time 240 km (150 miles) west of Bengkulu, 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. The following *Tectonic Summary* from NEIC nicely describes the plate tectonic and recent seismicity context of the October 25, 2010 event:

Tectonic Summary:

"The South Pagai, Sumatra earthquake of October 25, 2010 occurred as a result of thrust faulting on or near the subduction interface plate boundary between the Australia and Sunda plates. At the location of this earthquake, the Australia Plate move north-northeast with respect to the Sunda plate at a velocity of approximately 57-69 mm/yr. On the basis of the currently available fault mechanism information and earthquake depth it is likely that this earthquake occurred along the plate interface. The subduction zone adjacent to the region of this event last slipped during the Mw 8.5 and 7.9 earthquakes of September 2007, and today's event appears to have occurred near the rupture zones of those earthquakes. Today's earthquake is the latest in a sequence of large ruptures along the Sunda megathrust, including a M 9.1 earthquake that ruptured to within 800 km north of this earthquake in 2004; a M 8.7 700 km to the north between Nias and Simeulue in 2005; and a M 7.5 300 km to the north near Padang in 2009. Today's earthquake occurred near the southern edge of a Mw 8.7-8.9 rupture in 1797 and within the rupture area of a Mw 8.9-9.1 earthquake in 1833."

Initial reports indicated that only a minor tsunami produced by this earthquake with no reports of damage or injuries. However, by Tuesday morning, news reports were arriving from remote villages indicating that a significant local tsunami had swept through coastal towns on islands west of Sumatra. At this time, it is being reported that over 100 people were killed and hundreds are missing. This dramatic change in the news reports overnight is due to limited communication available in these remote areas.



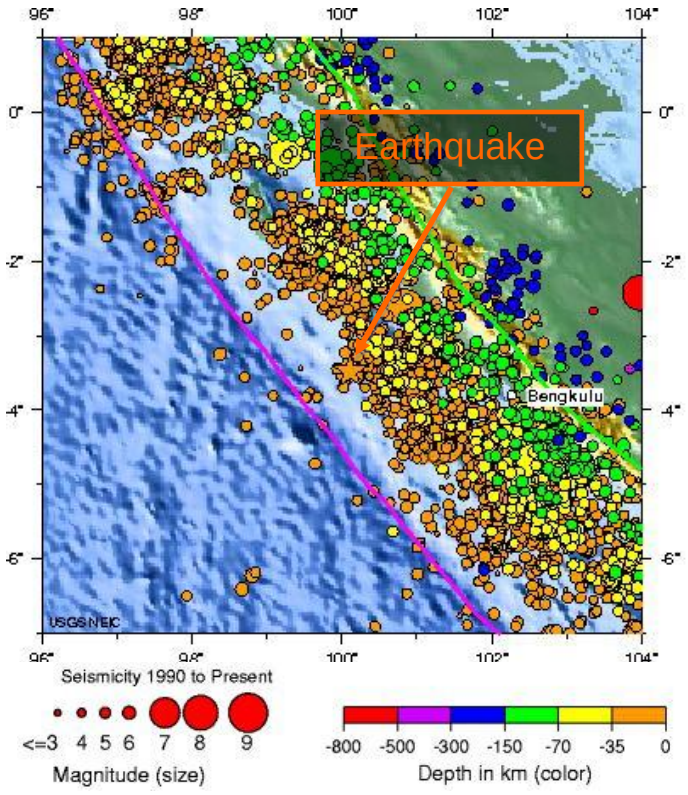


Image courtesy of the US Geological Survey

Seismogram Description:

The record of the magnitude 7.7 Indonesian earthquake on D03D, an Earthscope Transportable Array seismometer in Eldon, WA is illustrated below. Eldon, WA is about 13,598 km (122.50 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 Δ > 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° < Δ < 143°. The S-wave shadow zone exists for Δ > 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 Eldon, WA. PP is the first clear arrival marked on the seismogram and arrives 20 minutes 30 seconds after the earthquake. SS is a shear wave that also bounced midway between the epicenter and Eldon, WA. It took about 37 minutes 11 seconds for the SS waves to travel from the earthquake to Eldon, WA. The (Love and Rayleigh) surface waves traveled from the earthquake to Eldon, WA 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 Eldon, WA until 57 minutes 30 seconds after the earthquake occurred.