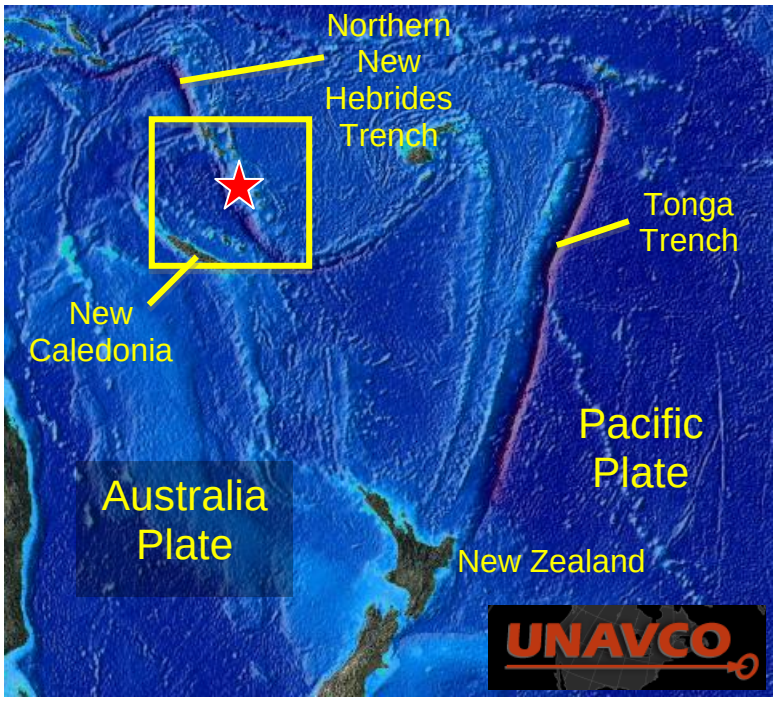
Magnitude 7.1 & 7.0 Earthquakes Near Vanuatu
Saturday, August 20, 2011
M7.1 at 16:55:03 UTC
Epicenter: Latitude 18.260°S, 168.069°E Depth: 40.6 kilometers.
M7.0 at 18:19:25 UTC
Epicenter: Latitude 18.287°S, 168.132°E Depth: 28.5 kilometers.

Earthquake Description:

As determined by the US Geological Survey National Earthquake Information Center (NEIC), a magnitude 7.1 earthquake occurred at 03:55:02 AM local time in the Northern New Hebrides Trench. At 05:19:24 AM local time, a magnitude 7.0 earthquake occurred with essentially the same epicenter but shallower depth. There were no immediate reports of damage and no tsunami was generated. Both earthquakes occurred in the subduction zone where the northeastern corner of the Australia Plate subducts beneath the Pacific Plate (Map A below). At this plate boundary, the convergence rate is 90 mm/year (9 cm/yr). Both earthquakes were ~65 km (~40 miles) south-southwest of Port-Vila, Efate, Vanuatu (Map B). The 1990-to-present earthquake history within the yellow square of Map A is shown on Map B where the yellow star indicates the location of the M7.1 August 20 earthquake. As illustrated on Map A, earthquake depths generally increase from southwest to northeast across this convergent boundary between the Australia Plate and the Pacific Plate. The relatively shallow depth of the August 20 earthquakes indicates that the foci of these events were on or near the plate boundary. The Northern New Hebrides Trench has been the site of several major earthquakes within the past two years. A M7.8 earthquake occurring on October 7, 2009 followed just 15 minutes later by a nearby M7.7 earthquake. A magnitude 7.2 earthquake occurred in the Northern New Hebrides Trench on May 27, 2010.

Map A



Map B

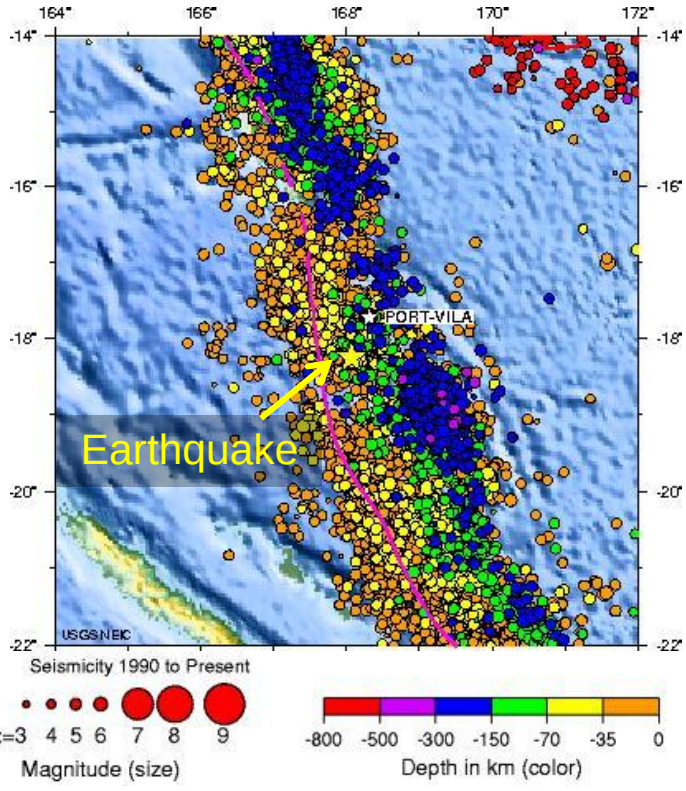


Image courtesy of the US Geological Survey

Seismogram Description:

The record of the M7.1 Vanuatu earthquake on the University of Portland seismometer in Portland, Oregon is illustrated below. Portland is about 9893 km (89.13°) from the location of this earthquake.

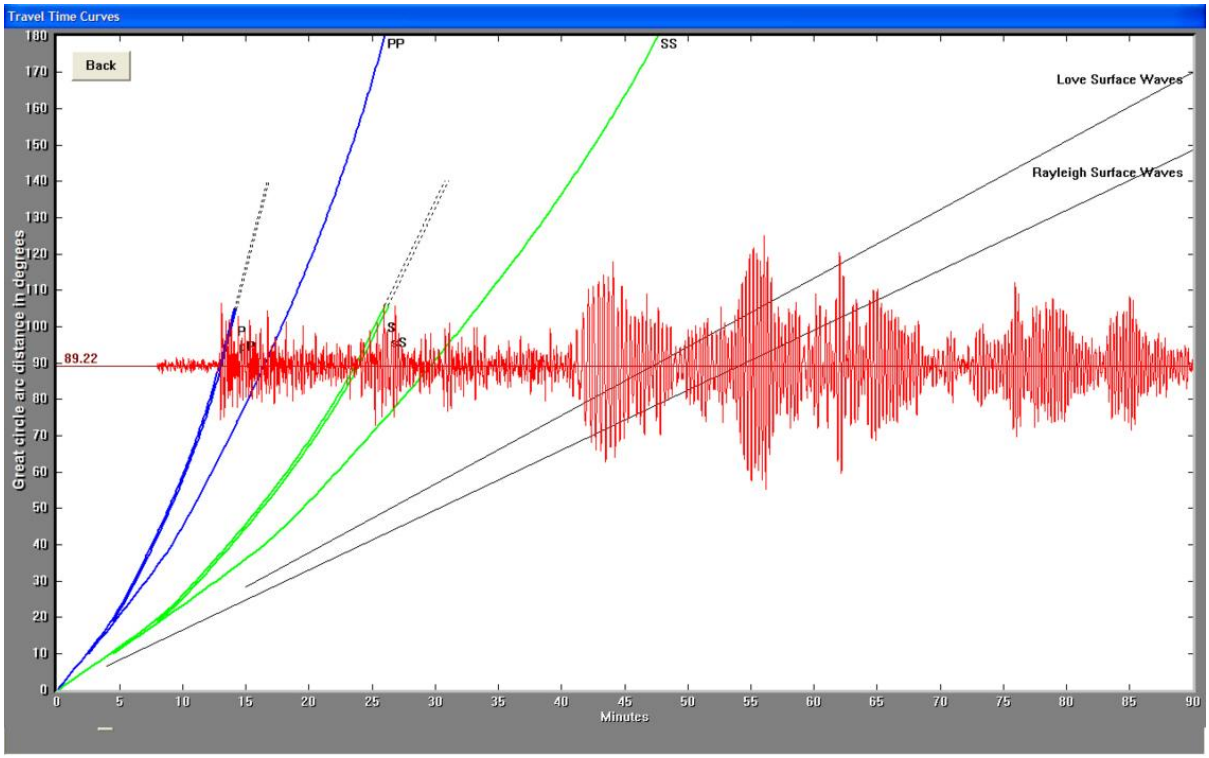
- P-waves are compressional waves that travel a curved path through the mantle. The P-waves arrived to the seismometer in Portland, Oregon 12 minutes 51 seconds (771 seconds) after the earthquake.

- PP waves are P waves that bounce once off the Earth's surface between the epicenter and the recording seismometer. PP waves arrive 16 minutes and 21 seconds (981 seconds) after the earthquake.

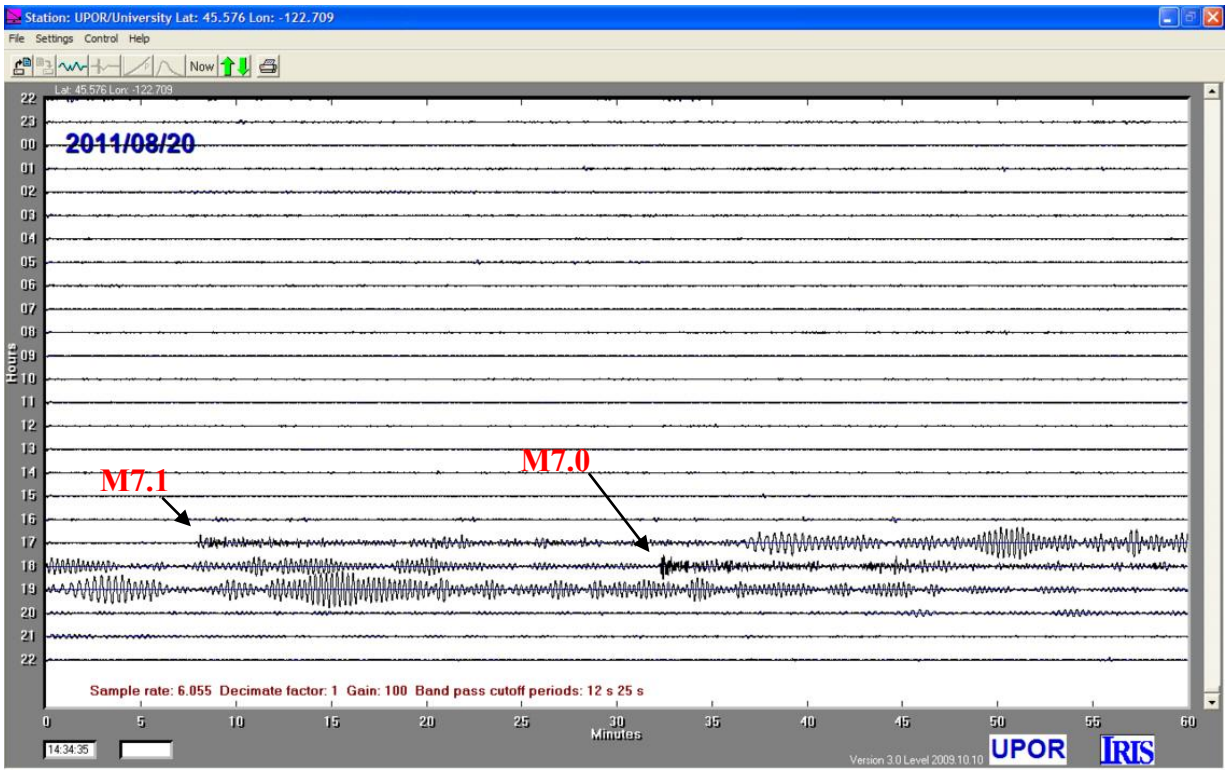
- Traveling the same path as the P-wave, the S-waves (shear waves) travel at a slower velocity, arriving 23 minutes 37 seconds (1417 seconds) after the earthquake.

- SS waves follow the path of the PP waves and arrive (1772 seconds) after the earthquake. The surface waves traveled from the earthquake to Portland, Oregon 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, it takes surface waves much longer than body waves to travel from an earthquake to a distant seismic station. In this case, the first surface waves from the Vanuatu earthquake started arriving in Portland, Oregon about 37 minutes after the earthquake occurred.



Following the M7.1 earthquake by 1 hour 24 minutes, a magnitude 7.0 earthquake occurred with essentially the same epicenter but shallower depth.



The record of the M7.0 Vanuatu earthquake on the University of Portland seismometer in Portland, Oregon is illustrated below. Portland is about 9892 km (89.12°) from the location of this earthquake.

- P-waves arrived 12 minutes 52 seconds (772 seconds) after the earthquake.
- PP waves arrived 16 minutes and 22 seconds (982 seconds) after the earthquake.
- S-waves arrived 23 minutes 39 seconds (1419 seconds) after the earthquake.
- SS waves arrived 29 minutes 34 seconds (1774 seconds) after the earthquake.
- The first surface waves started arriving about 37 minutes after the earthquake occurred.