

## Magnitude 7.8 SCOTIA SEA

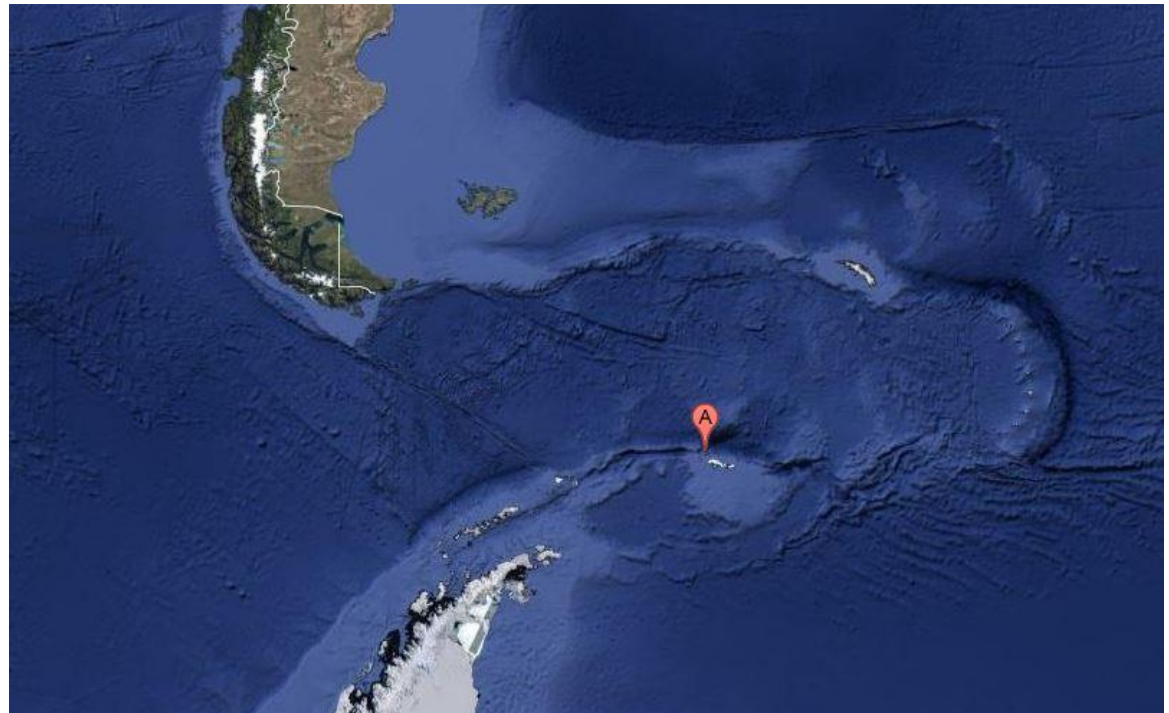
Sunday, November 17, 2013 at 09:04:55 UTC



A magnitude 7.8 earthquake has occurred in the South Orkney Island region in the Scotia Sea.

According to the USGS, this earthquake is the latest in a series of moderate-to-large earthquakes to strike this region over the past several days. The earthquakes began Wednesday, November 13 with a M 6.1 event about 50 km to the west of this earthquake. Two days later, a M 6.8 earthquake struck very close to the preceding M 6.1.

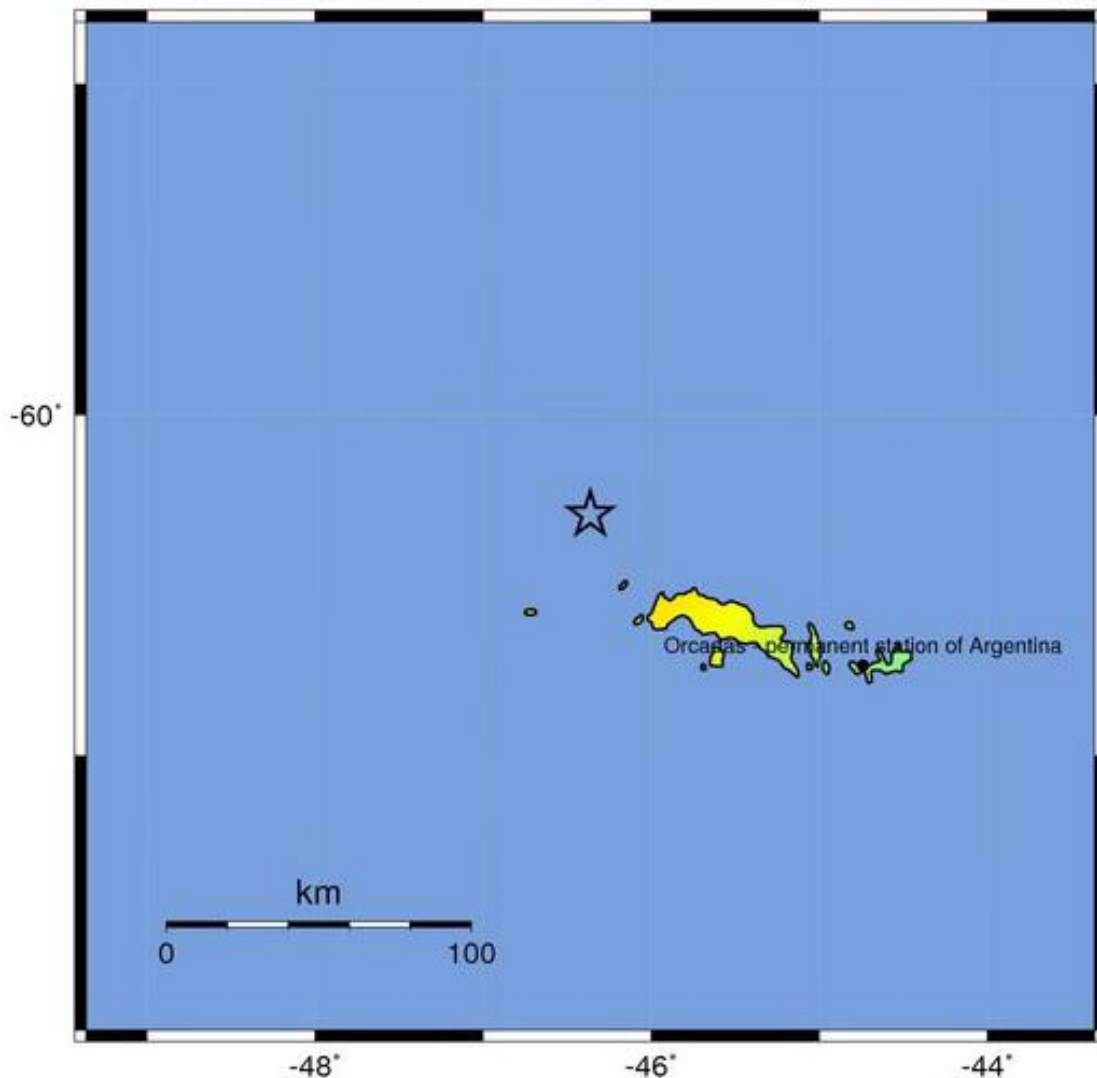
Twenty aftershocks ranging from M 4.6 to M 5.3 occurred near the epicenter within 8 hours of this M 7.8 event. All are aligned along the southern boundary of the Scotia Plate.



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

The area nearest the epicenter experienced very strong shaking.

| Modified Mercalli Intensity | Perceived Shaking |
|-----------------------------|-------------------|
| X                           | Extreme           |
| IX                          | Violent           |
| VIII                        | Severe            |
| VII                         | Very Strong       |
| VI                          | Strong            |
| V                           | Moderate          |
| IV                          | Light             |
| II-III                      | Weak              |
| I                           | Not Felt          |





The island nearest to the earthquake (Islas Orcadas del Sur) is the location of the Orcadas Base, an Argentine scientific station in Antarctica. It is the oldest of the stations in Antarctica still in operation and has been permanently populated since 1904.



*Orcadas Base, 26 December 1996, Islas Orcadas del Sur*

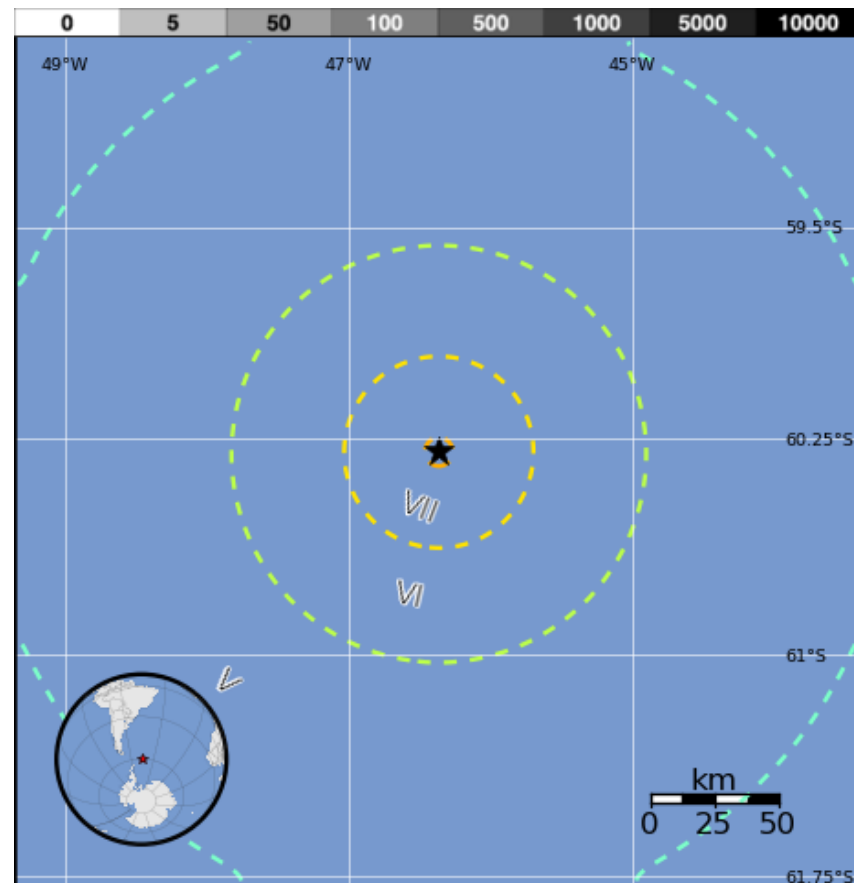


The USGS PAGER map shows the population exposed to different Modified Mercalli Intensity (MMI) levels.

The USGS estimates that no cities experienced shaking from this earthquake. Likely, only scientists at nearby research stations felt this earthquake.

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 below.

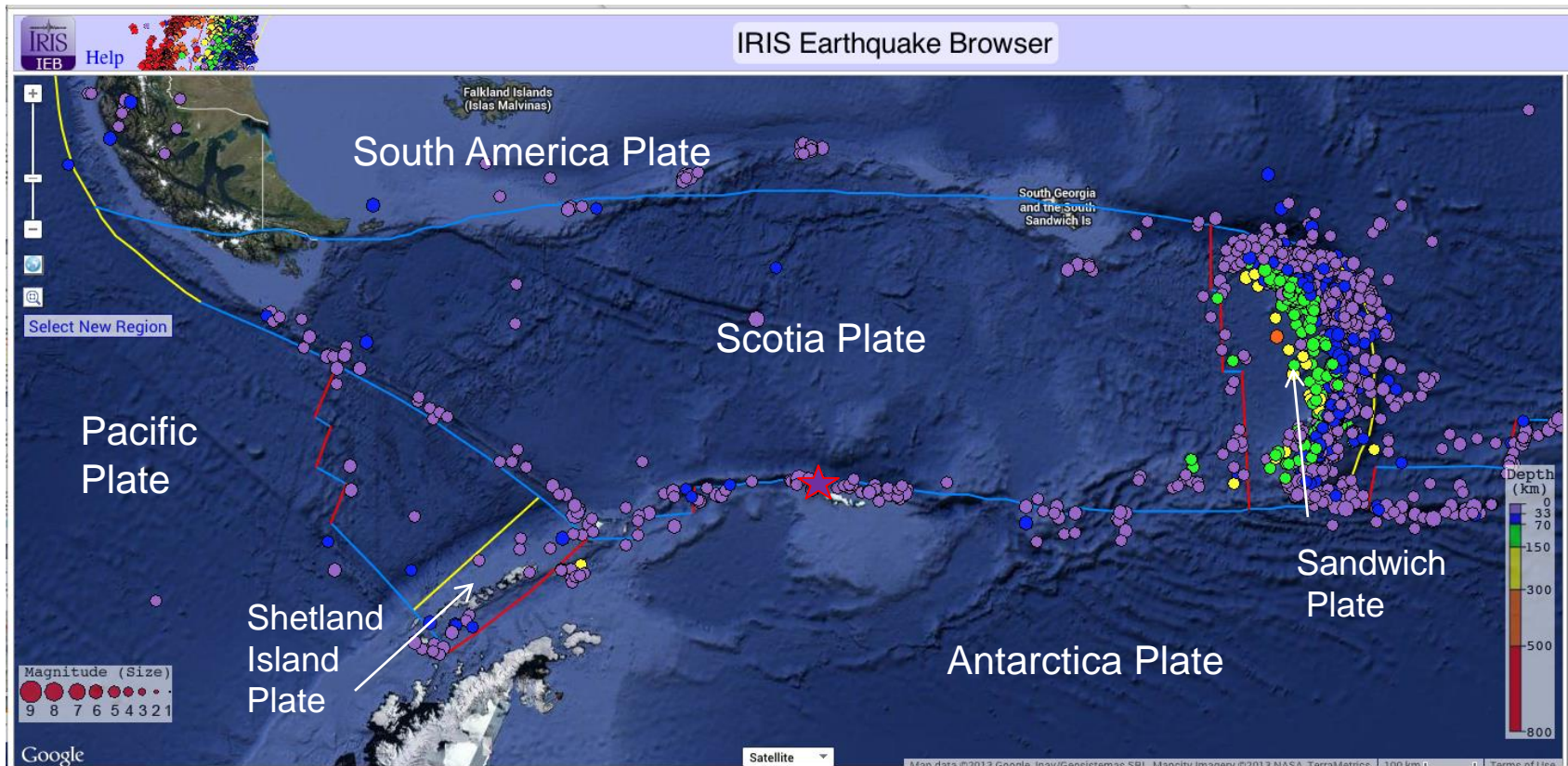
*Image courtesy of the US Geological Survey*



| Estimated <a href="#">Modified Mercalli Intensity</a> | I        | II-III | IV    | V        | VI     | VII         | VIII   | IX      | X       |
|---|----------|--------|-------|----------|--------|-------------|--------|---------|---------|
| Est. Population Exposure                              | --*      | --*    | --*   | 0k       | 0k     | 0k          | 0k     | 0k      | 0k      |
| Perceived Shaking                                     | Not Felt | Weak   | Light | Moderate | Strong | Very Strong | Severe | Violent | Extreme |

This earthquake epicenter is plotted on the map with regional earthquakes in the range of magnitude 5 to magnitude 8 since 1973.

The Scotia Plate is caught between the Antarctic and South America Plates and is bounded on its north and south sides by plate boundaries that are dominantly transform (strike-slip) boundaries.

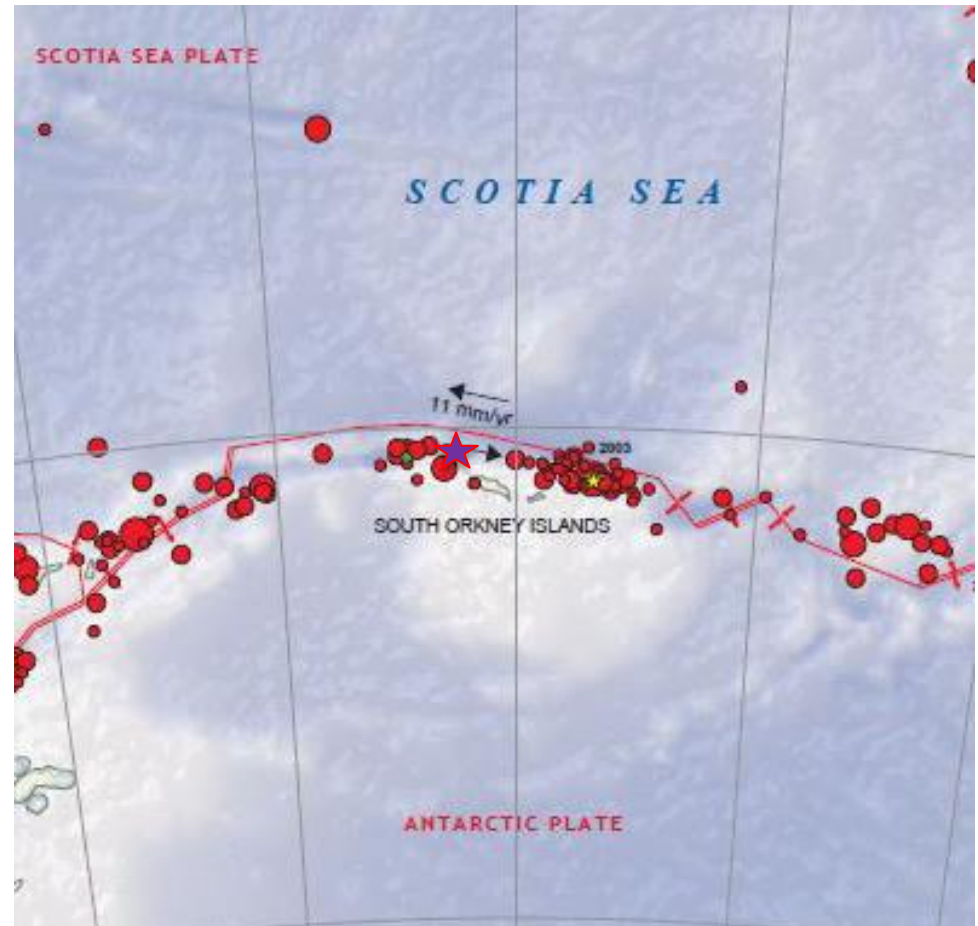


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The recent earthquakes occurred on or near the South Scotia Ridge, a left lateral transform boundary between the Scotia and Antarctica Plates that is sliding at a rate of ~11 mm/yr.

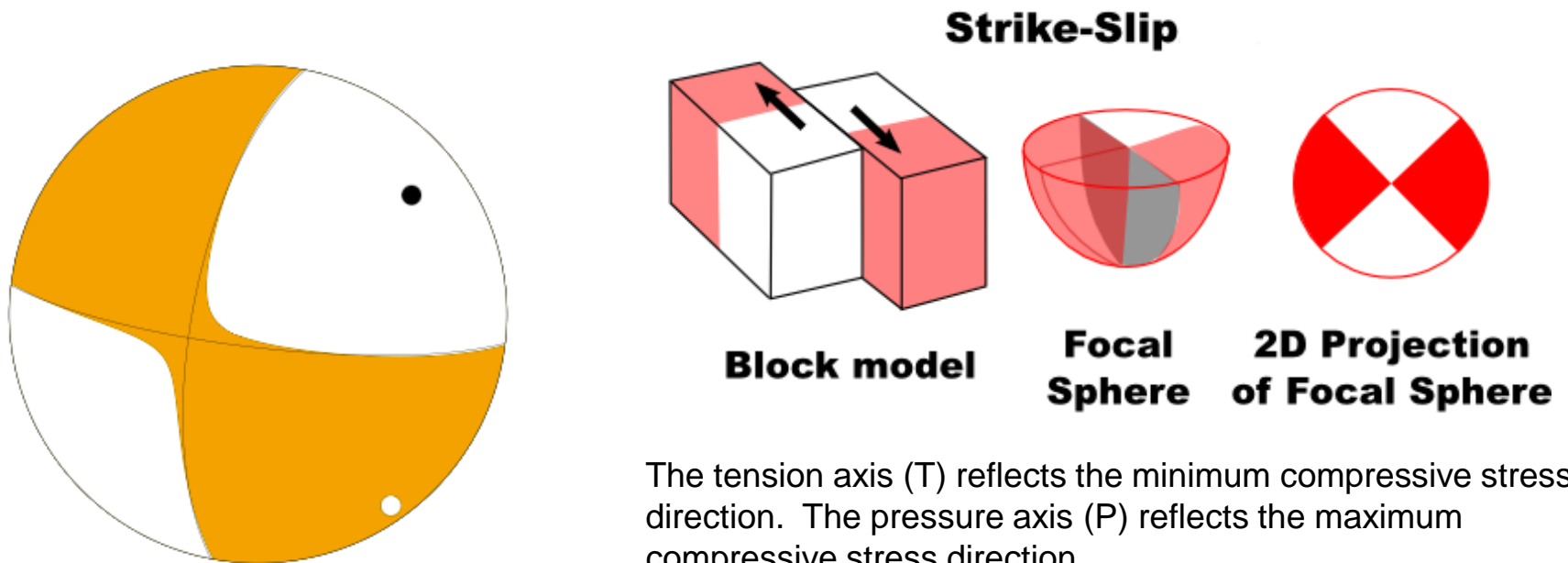
According to the USGS, there are no land-based observations within the Scotia Plate to measure plate motion; all reported plate motions are derived from remote earthquake recordings.



*Image courtesy of the US Geological Survey*

The focal mechanism illustrated below indicates that the earthquake resulted from either left-lateral strike-slip motion on an east-west oriented fault plane or right-lateral strike-slip motion on a north-south oriented fault plane.

Given the east-west alignment of historic earthquakes along the Scotia – Antarctic plate boundary, it is most likely that this earthquake was produced by left-lateral strike-slip motion on this transform boundary.

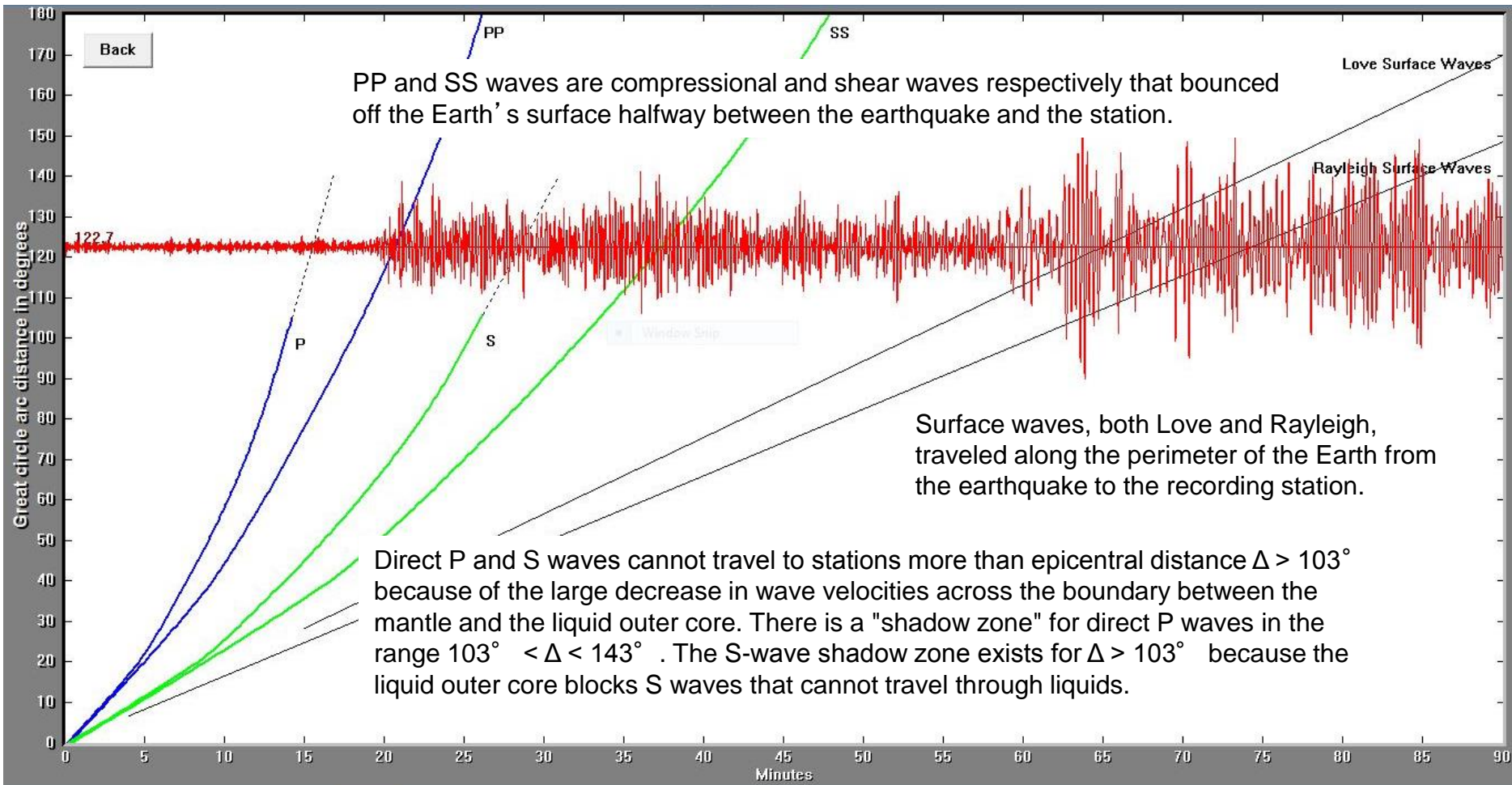




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The record of the earthquake on the University of Portland seismometer (UPOR) is illustrated below. Portland is 13,610 km (8458 miles, 122.6° ) from the location of this earthquake.






Animation explaining the seismic shadow zone.

Epicentral distance 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.

S waves are seen up to a distance of  $104^\circ$  from an earthquake, but direct S waves are not recorded after this distance.


P waves also have a shadow zone between  $104^\circ$  and  $140^\circ$

1.ShadowZones\_640\_med
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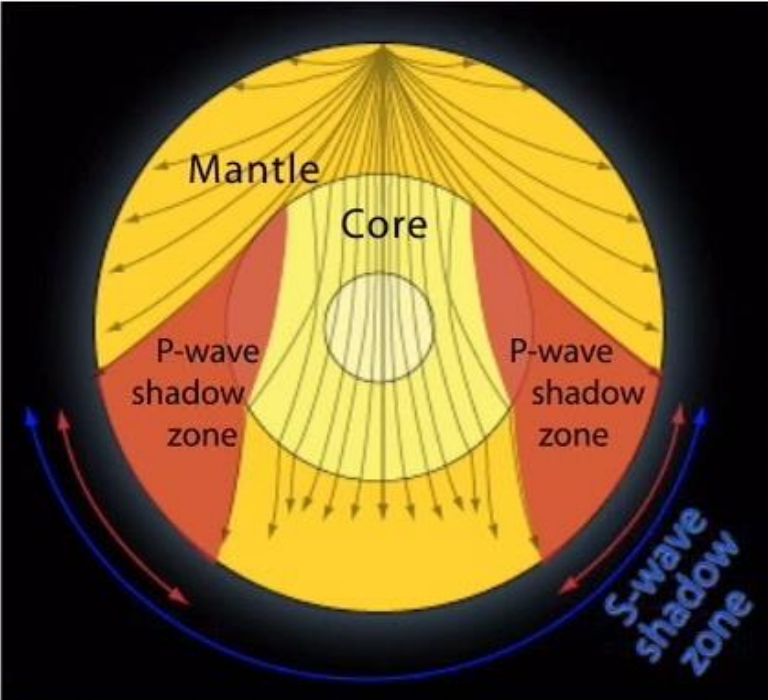
## Seismic Shadow Zones

How the mantle and core were determined using the arrival times of direct P and S body waves



**P waves** (primary) are compressive waves that travel through solids & liquids.

**S waves** (secondary) are shear waves that travel through solids only.



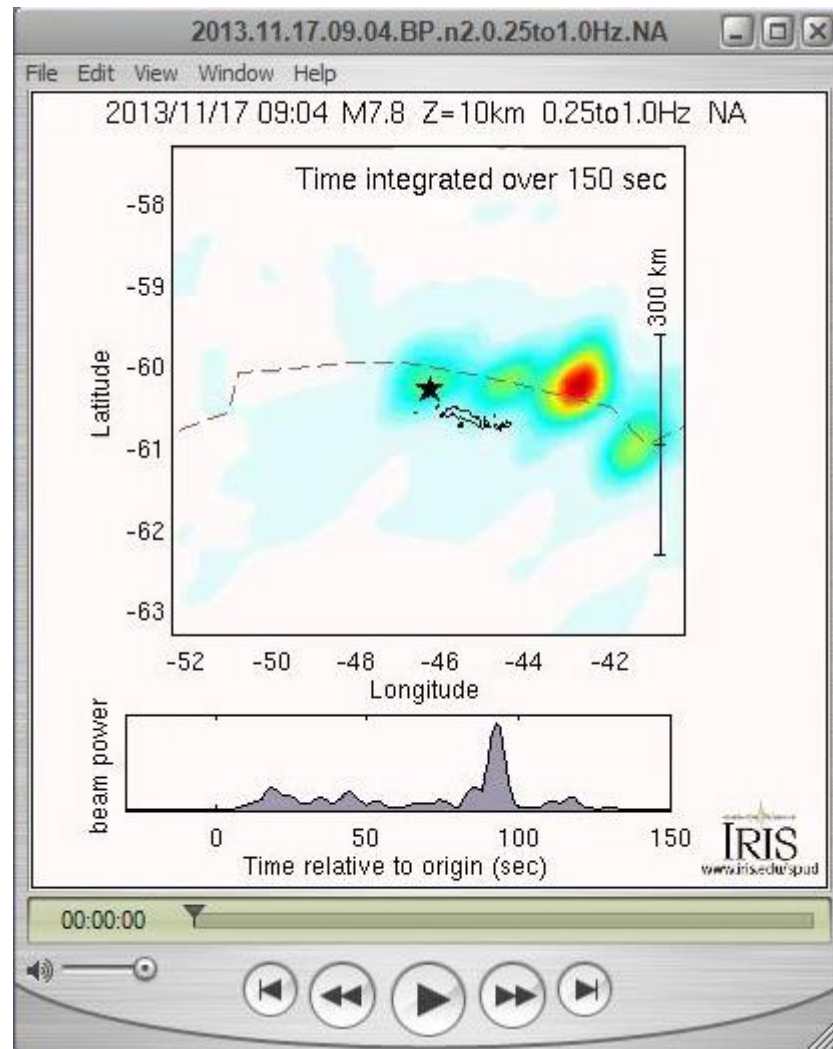
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Back Projections are movies created from an automated data processing sequence that stacks up P wave energy recorded on many seismometers on a flat grid around the source region. This grid approximates the fault surface and creates a time and space history of the earthquake.

Warmer colors indicate greater beam power. In the movies, a red circle shows the location of the peak beam power when absolute beam powers are low.

Duration of rupture along the fault can be seen in the graph.



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