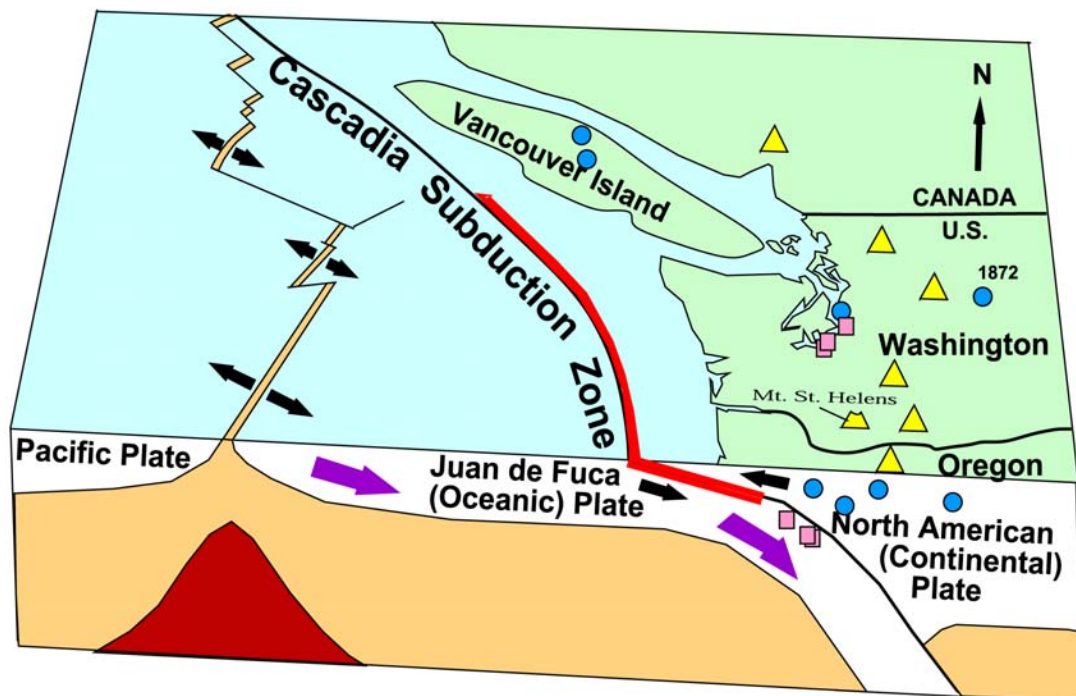






Earthquake Hazards in Washington and Oregon Three Source Zones

Damaging Pacific Northwest earthquakes can arise from three distinct source zones:
Deep earthquakes beneath the Puget Sound have damaged Seattle and Olympia
Shallow faults can cause intense local shaking – urban areas are especially vulnerable
An offshore subduction zone fault can cause strong shaking across the entire region.



-  Deep earthquakes (30 miles below the Earth's surface) are within the subducting oceanic plate as it bends beneath the continental plate. The largest deep Northwest earthquakes known were in 1949 (M 7.1), 1965 (M 6.5), and 2001 (M 6.8).
-  Shallow earthquakes (less than 15 miles deep) are caused by faults in the North American Continent. The Seattle fault produced a shallow magnitude 7+ earthquake 1,100 years ago. Other magnitude 7+ earthquakes occurred in 1872, 1918, and 1946.
-  Subduction earthquakes are huge quakes that result when the boundary between the oceanic and continental plates ruptures. In 1700, the most recent Cascadia Subduction Zone earthquake sent a tsunami as far as Japan.
-  Mt. St. Helens/Other Cascade Volcanos

| SOURCE ZONES | Deep | Shallow | Subduction Zone |
|-----------------------------|--|--|---|
| How Big? | | | |
| Largest Known | 7.1 1949, Olympia | 7.4 1872, North Cascades 900 AD, Seattle | 9.0 1700, Coast of WA, OR, CA, and BC |
| Largest Possible | 7.5 | less than 8 | 9+ |
| Where is the Rupture? | 20-45 miles deep, beneath Puget lowland, Willamette Valley, Strait of Georgia. | Seattle, Portland, North Cascades, Vancouver Island, other unidentified locations | Offshore, on a shallow-dipping fault that runs from Vancouver Island to Northern California |
| How deep is the Rupture? | At a depth of 30-40 miles. | Less than 15 miles deep; may break the surface. | From 20 miles depth to the surface |
| How Often? | Five magnitude 6 earthquakes, plus one magnitude 7 since 1900. | Four magnitude 7 or greater known in the last 1,100 years; including two since 1918 on Vancouver Island | Every 400-600 years; intervals between events are irregular. The most recent was in 1700. |
| Why? | Gravitational pull and phase changes within subducting oceanic Plate | Crustal Stresses | Plate convergence at locked interface between Juan de Fuca and North American Plates |
| Precursors? | None expected | Unclear | Probable |
| Aftershocks? | Damaging aftershocks unlikely, none noted in 1949 or 1965. In 2001, aftershocks were few and small | Many expected, magnitudes to 6.5 | Many expected, magnitudes to 7.5 |
| Shaking Duration? (on rock) | 15-30 seconds of strong shaking* | 20-60 seconds of strong shaking* | 1-3 minutes of strong shaking* for a magnitude 8 |
| Shaking Strength? (on rock) | | Greater than 0.5 g** | 0.3 g in urban areas** Greater than 0.5 g near coast** Longer period shaking than other sources |
| Tsunami? | Not from fault motion, but landslides could trigger local tsunamis. | Possible in Puget Sound if the rupture is under water and displaces the bottom of the Sound, or if landslides trigger local tsunamis. | Yes , near coast |
| Liquefaction? | Yes | Yes | Yes |
| Landslides? | Yes | Yes | Yes |

* Durations of strong shaking on rock; longer durations are expected on soft ground

** Accelerations on rock; larger accelerations are expected on soft ground

Acceleration values are in reference to the acceleration due to Earth's gravity, "g"