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Earthquakes in southwestern British Columbia

Geological Survey of Canada.

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Earthquakes in southwestern British Columbia

Southwestern British Columbia is one of the most seismically active regions in Canada. Approximately 400 earthquakes occur each year in the region extending from the north end of Vancouver Island to Seattle, Washington U.S. seen on the map below. About a dozen of these earthquakes are felt by people, but many of the larger earthquakes occur offshore. Earthquakes capable of causing structural damage happen every decade or so.

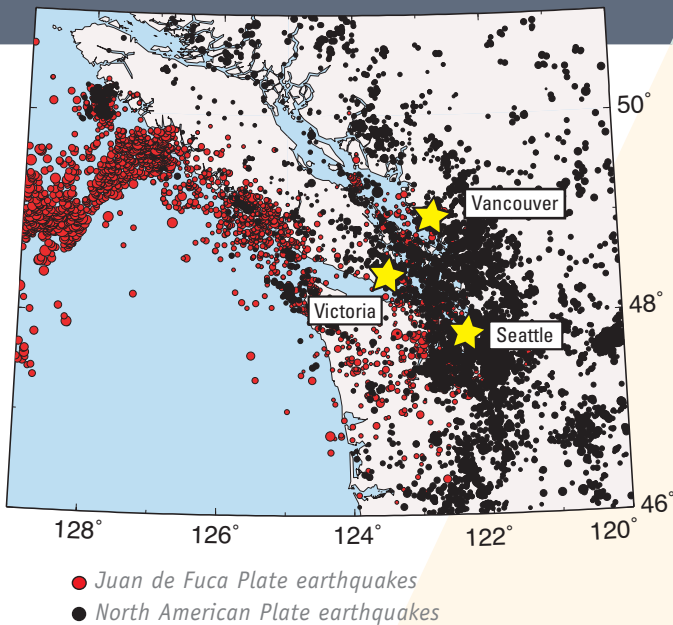
What Causes Earthquakes?

The surface or *crust* of the Earth is always moving. Large segments of this crust, called *tectonic plates*, continually shift against each other, causing stress to build-up. When the stress becomes too great, a sudden rupture or earthquake occurs along a zone of weakness called a *fault*, generating seismic waves. Earthquakes occur most frequently where tectonic plates interact - such as the Cascadia Subduction Zone of southwestern British Columbia.



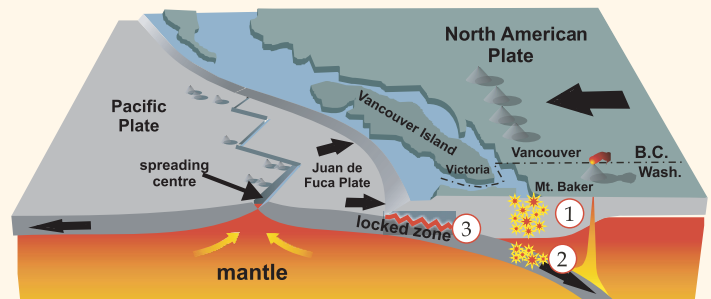
Maintaining the antennae that receive earthquake data from remote stations.

15 Years of Earthquakes



The Cascadia Subduction Zone (CSZ)

Southwestern British Columbia is located above the boundary between the oceanic Juan de Fuca Plate and the continental North American Plate. This boundary, the Cascadia Subduction Zone, spans 1000 km from northern Vancouver Island to northern California. The Juan de Fuca Plate is descending or *subducting* beneath the North American Plate at roughly the same rate as fingernails grow – about four centimetres per year.



Earthquakes occur in three regions of southwestern British Columbia. Regions 1 - 3 described on next page.

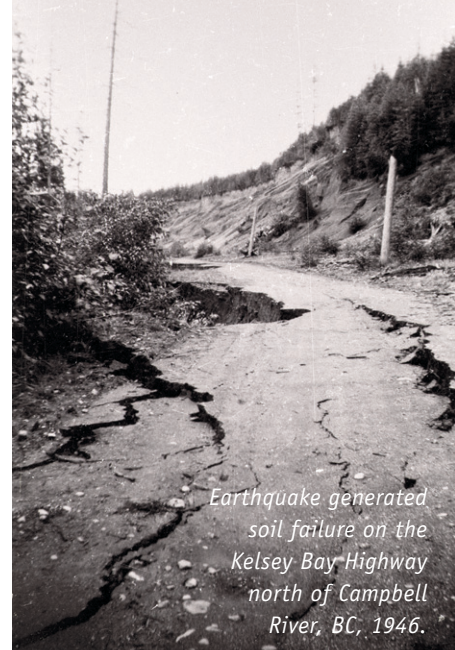


Earthquake damage to the Bank of Montreal, Port Alberni, BC, 1946.

1. North American Plate Earthquakes

Earthquakes that occur within the overriding North American Plate can cause the most damage because they are located closest to the Earth's surface. The closer an earthquake is to the surface, the stronger the shaking will be. These earthquakes are often followed by a series of smaller earthquakes called *aftershocks*.

Southwestern British Columbia's largest recorded earthquake is an example of a North American Plate earthquake. This M7.3 earthquake occurred on June 23, 1946 near the central Vancouver Island town of Courtenay. In communities close to the epicentre, 75 per cent of chimneys were damaged. People felt the shaking in Victoria, Vancouver and as far east as the Rocky Mountains.



Earthquake generated soil failure on the Kelsey Bay Highway north of Campbell River, BC, 1946.

February 2001 (below): A car is damaged by the earthquake in Seattle.
Photo Andrea J. Wright/The Seattle Times



2. Juan de Fuca Plate Earthquakes

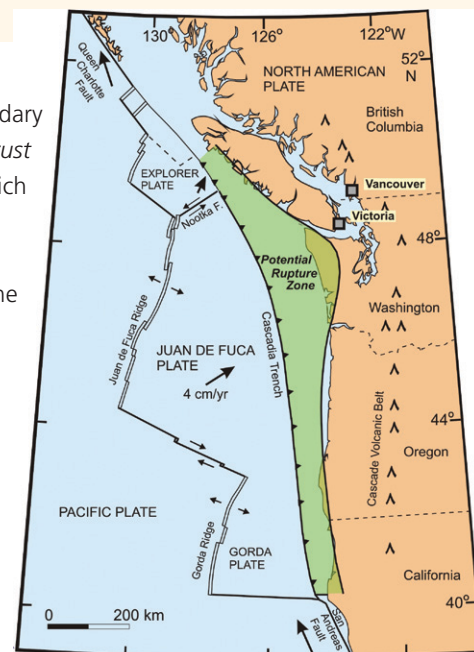
- Earthquakes in the subducting Juan de Fuca Plate have been the most frequent type of damaging earthquakes in southwestern British Columbia. These earthquakes occur in a band stretching from mid-Georgia Strait, BC to southern Puget Sound, Washington at depths of 40 to 60 kilometres below the surface. They usually have few or no aftershocks.

In 2001, a M6.8 earthquake strongly shook Seattle and the Puget Sound area and was widely felt in Victoria and Vancouver. This earthquake occurred within the Juan de Fuca Plate at a depth of about 50 kilometres and caused \$2 billion (2001 dollars) in damage.

3. Plate Boundary Earthquakes

- The earthquakes that occur along the boundary between the North American Plate and the subducting Juan de Fuca Plate are called *megathrust* earthquakes. The potential rupture area lies west of Vancouver Island. These earthquakes which can be up to magnitude 9, occur every 200 to 800 years and cause large tsunamis. Exposed coastlines and inlets along the west coast of Vancouver Island and the United States will bear the brunt of a tsunami. There will be only a 15 to 30 minutes between the earthquake and the arrival of the first tsunami waves.

The last megathrust earthquake on the Cascadia Subduction Zone occurred on January 26, 1700. The entire zone from Northern Vancouver Island to Northern California ruptured. It was an estimated M9. Written records of the tsunami damage along the east coast of Japan provide a precise date and time for this event. Vancouver Island First Nations' oral histories describe how the same tsunami destroyed a village at Pachena Bay on the west coast of the island, leaving no survivors. They also say the shaking damaged houses in the Cowichan Lake region of south central Vancouver Island.



Megathrust (Subduction earthquake) Rupture Zone

Government of Canada monitoring and research on earthquakes is undertaken by Natural Resources Canada's Earth Sciences Sector.

For more information on earthquakes visit the Geological Survey of Canada, NRCan website:
EarthquakesCanada.nrcan.gc.ca

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