

FIRST NATIONS TRADITIONS LESSON PLAN

A Tsunami Hits Hot Springs Cove

Duration:	2 classes
Students will:	<ul style="list-style-type: none">• Read a first-hand account of the March 27, 1964 tsunami that hit the west coast of Vancouver Island.• Write newspaper/magazine articles about that tsunami.• Prepare check-lists for earthquake and tsunami preparedness.• Research earthquakes and tsunamis that have impacted the west coast of Vancouver Island.• Examine various perspectives and ways of recounting events.
Vocabulary:	<p>Plate tectonics: The theory that the Earth's surface is made up of rigid moving plates.</p> <p>Subduction Zone: Areas where the plates come together and one plate sinks below the edge of the other.</p> <p>Convergent Boundaries: The “seams” where plates meet. In a convergent boundary, plates collide. Typically, the oceanic plate is forced underneath the continental plate creating a subduction zone.</p> <p>Juan de Fuca Plate: Oceanic tectonic plate that runs from Southern British Columbia to the Pacific Northwest (USA).</p> <p>North American Plate: Continental tectonic plate covering most of North America, Greenland, and part of Siberia.</p> <p>Cascadia Subduction Zone: Very long sloping fault that stretches from mid-Vancouver Island to Northern California; where the Juan de Fuca and North America plates collide.</p> <p>Tsunami: Ocean waves that are caused by an earthquake or an underwater volcano.</p>

British Columbia PLO's:

- Science 7, 10
- First Nations Studies 12
- English 12 First Peoples
- Planning 10

Background:

- Scientists use a model of the Earth comprised of: the crust, the mantle, the outer core and the inner core. The outermost part of the Earth (the surface) is made up of the crust and upper mantle – a rigid layer called the lithosphere. Below the lithosphere is the asthenosphere. The Earth's lithosphere is made up of seven very large pieces called tectonic plates. These plates 'drift' or move in relation to one another at rates between 2 cm. and 10 cm. a year. There are also many minor plates. Plate tectonics is the term used to describe the large scale motions of the Earth's lithosphere. Plate boundaries are marked by numerous active faults. This is the area where earthquakes, volcanic activity, mountain-building and oceanic trench formation occur. There are three types of plate boundaries: convergent boundaries where plates are colliding or moving together; divergent boundaries where plates are moving apart; and transform boundaries where plates are sliding sideways.
- In a convergent boundary, a dense oceanic plate collides with a less-dense continental plate. Typically the oceanic plate is thrust underneath the continental lithosphere and this forms a subduction zone.
- The Alaska earthquake of 1964 was a subduction zone earthquake and a megathrust earthquake. The Alaska quake was the result of the Pacific plate colliding with the North American plate and rupturing near Prince William Sound, Alaska. This rupture occurred at approximately 25 km. beneath the surface of the Earth. The shifts in the ocean floor created tsunamis up to 20 m. in height. A 1.4 m. wave reached Prince Rupert about three hours after the quake. The tsunami, upon reaching Vancouver Island damaged towns and villages along the west coast including Port Alberni, Hot Springs Cove and Zeballos. The damage in British Columbia was estimated at \$10 million at the time. Aftershocks from the quake continued for 18 months following the initial event.
- The Cascadia subduction zone forms the boundary between the eastward-moving Juan de Fuca plate and the westward-moving North America plate and spans a distance of more than 1000 km from central Vancouver Island to northern California. Off central Vancouver Island, the Nootka fault separates the Juan de Fuca plate from the slowly subducting Explorer Plate.
- In the Cascadia subduction zone the oceanic plate - the Juan de Fuca Plate – is sinking underneath the continental plate - the North America plate - at a rate of 40 mm/year.
- The width of the Cascadia subduction zone fault varies along its length, depending on the temperature of the subducted oceanic plate, which heats up as it is pushed deeper beneath the continent. As the plate becomes hotter and more molten, it eventually loses the ability to store mechanical stress that is caused by the temperature increase and thus an earthquake is generated. The Juan de Fuca

plate is only about 9 million years old. Because it is so young, it is hot and buoyant.

- The last subduction zone or megathrust earthquake that occurred in the Cascadia subduction zone was on January 26, 1700. This is known from geological data, historical accounts from Japan, and oral accounts preserved by local First Nations people and families. Science has only recently begun to recognize and incorporate First Nations knowledge in its findings and conclusions.
- The lack of written recorded evidence of past earthquake activity led scientists to argue in the 1960s and 1970s about the danger in the Cascadia subduction zone. A scientific breakthrough in the debate occurred when Tom Heaton of the U.S. Geological Survey and Garry Rogers of the Geological Survey of Canada independently suggested that subduction between the Juan de Fuca plate and North American plate was not continuous, but that the plates are locked or stuck for hundreds of years. Their argument is now widely accepted. If (when) the entire locked Cascadia subduction zone ruptures at once, the resulting earthquake would be a megathrust earthquake with a magnitude of at least 9.
- A megathrust earthquake occurs when the plates periodically unlock to produce giant earthquakes along the subduction zone. About 20 years ago Thomas H. Heaton of the U.S. Geological Survey and Garry C. Rogers of the Geological Survey of Canada began warning that giant earthquakes could indeed strike this seemingly quieter stretch of coast (1985, confirmed in 1995).
- Measurements taken from survey points in Victoria and Penticton, British Columbia, have demonstrated that the two sites move closer together at an average rate of 7 millimetres per year (using differential GPS).
- We live in an area that is accumulating huge amounts of energy that will someday be released in a giant earthquake when the fault ruptures.
- It is now known that an earthquake along the Cascadia Subduction Zone occurs on average every 300 years. At present, there is evidence that indicates that there have been 7 of these megathrust earthquakes over the last 3,500 years and that they have occurred at intervals between 100 and 1000 years.
- To relieve pressure, slip events occur at intervals of 13 – 15 months along the subduction zone and last for 10 – 20 days. These events migrate laterally along the length of the subduction zone. It is thought that a future silent slip may trigger a megathrust earthquake. However, the reality remains that earthquakes are unpredictable.
- At present, scientists monitor these slip events and the hope is that they will be able to warn the public if an earthquake occurred along the subduction zone.
- In 2003, the governments of BC and Canada approved funding for the Canadian part of the Neptune Project, a \$100 million network of 800 km. of electro-optic cable laid on the seabed over the northern part of the Juan de Fuca tectonic place,

a 200,000 sq. km. region in the northwest Pacific off the coasts of British Columbia, Washington, and Oregon.

Materials:

- Ocean News article: [A Tsunami Hits Hot Springs Cove](#)
- Map of Vancouver Island or Clayoquot Sound to locate Hot Springs Cove.

Procedure:

1. As a class or individually read the Ocean News article: [A Tsunami Hits Hot Springs Cove](#).
2. With the students look at a map of Vancouver Island and/or Clayoquot Sound and locate Hot Springs Cove.
3. Ask the students to imagine that they are journalists or reporters in 1964 who have been asked to write feature articles about this tsunami. You may want to divide the class into two groups having one group writing for the “Science Digest” and the other writing for their local newspapers.
4. Alongside their articles, have students create a “What to do in the event of a Tsunami” and/or “What to do in the event of an Earthquake” check-list. Their check-lists are to appear alongside their published articles.
5. Provide class time for students to work on their articles and check-lists. Instruct students to do additional research on the Alaska earthquake and resulting tsunami, on earthquakes and tsunamis in general, and on the potential for future earthquakes and tsunamis along the Cascadia subduction zone. (Some of this work may be assigned as homework.)

Things to Consider in Writing a News Article

Who are you writing the article for?

What information do you want to convey?

Remember the 5 W’s and H – Who? What? Where? When? Why? How?

Tips for Writing a News Article

The **Headline** should capture your readers’ attention.

The **Lead** or first sentence usually contains the most important news, and makes the reader want to read further.

A good **Quote** or quotes gives life to an article.

The **Body** of the article answers questions a reader may have about the event.

The **Ending** sums up and leaves the reader with something to remember or think about.

Wrap-up:

1. Have students present their finished articles and check-lists in small groups (If you have divided your ‘reporters’ into two groups, make sure that members of both groups are present in these small groups).
2. Have students discuss in their groups the information presented in their articles and check-lists and the similarities and differences in the various articles.
3. Discuss with the class as a whole the information presented in the tsunami articles and check-lists and the different ways that students chose to emphasize certain information. For example, some students may choose to emphasize the oral account of the tsunami’s effects, others may choose to emphasize the science of earthquakes and tsunamis. Discussions should lead to a consideration of different ways of expressing information about the same event, the validity of different perspectives, and the merits of using a broad range of information sources to learn and explain more about an event.

Discussion:

- What information is presented by the news articles and checklists?
- How were the various news articles similar?
- How were the various news articles different?
- Think about how the ‘aim’ or perspective of the reporter and/or the publication the reporter is working for might affect the news article that results. What sorts of information might you expect from a news article written for a local paper? A magazine that focuses on science?
- Is one set of information ‘better’ or more accurate than another?
- How can different sets of information about the same event complement one another?
- How can reporting on earthquakes and tsunamis (and other natural disasters) help people to better understand and prepare for such events in the future?

Extension and Resources:

- A good description of the March 27, 1964 Alaska earthquake and resulting tsunami can be found at [Wikipedia](http://en.wikipedia.org/wiki/Good_Friday_Earthquake) {en.wikipedia.org/wiki/Good_Friday_Earthquake}
- A description of the May 23, 1960 Chilean earthquake and resulting tsunamis can also be found at [Wikipedia](http://en.wikipedia.org/wiki/May_23_1960_Chilean_earthquake)
- In their oral history the Huu-ay-aht People, whose traditional territories include the area around modern-day Bamfield on the west coast of Vancouver Island, have a story of a major earthquake and tsunami that wiped out one of their villages at Pachena Bay in 1700.
<http://oceanlink.island.net/SOLE/tectonics/cascadia5.html#cas/> Reference to the

- Huu-ay-aht story about this earthquake and tsunami can be found at [Wikipedia](https://en.wikipedia.org/wiki/Cascadia_Earthquake) {en.wikipedia.org/wiki/Cascadia_Earthquake} and [EQ News](http://www.seismowatch.com/EQSERVICES/Newsletter/EQNEWS9701.html) {www.seismowatch.com/EQSERVICES/Newsletter/EQNEWS9701.html}
- Information about earthquake and tsunami preparedness is available from the [Provincial Emergency Program](http://www.pep.bc.ca/hazard_preparedness/Earthquake_Information.html) {http://www.pep.bc.ca/hazard_preparedness/Earthquake_Information.html}

Author: Karen Charleson, 2008.

For more information please contact the Public Education Department at the [Bamfield Marine Sciences Centre](#) or [OceanLink](#)