

'Catastrophic' earthquake and tsunami brewing off B.C. coast

BY MARGARET MUNRO, POSTMEDIA NEWS DECEMBER 29, 2014



Pacific Rim National Park.

VICTORIA – The pressure has been building for more than 300 years.

A giant slab of rock sliding in from the Pacific is exerting so much pressure on the west coast of North America it is warping Vancouver Island, tilting it higher and squeezing it a few centimetres eastward every year.

One day, the strain will be released in an instant and a catastrophic earthquake will rip down the west coast from British Columbia to northern California. Geologists can't predict when the mega-thrust quake will hit, but they say it is inevitable.

Parts of the coast will suddenly sink more than a metre and jump 10 to 15 metres to the west when the tectonic plates on the 1,130-kilometre Cascadia subduction zone slide past each other.

The ground shaking will be so intense older bridges and unreinforced buildings will crack and many are expected to collapse. Landslides will cut off roads, railways and millions of people could be left — for days, and in some areas, possibly weeks — without phone, cable, power and water. The coast will be hammered as a tsunami sends a wall of water racing ashore, that could wash away resorts, campgrounds, rearrange shipping channels, and sever major undersea cables.

"There would be widespread damage, including thousands of injuries and fatalities and the destruction of hundreds of buildings," says a recent [report](#) from B.C.'s auditor general that harshly criticized the province for not being better prepared for the catastrophe and its aftershocks.

Megaquakes on North America's west coast are rare but they occur like clockwork about every 500 years, say scientists, who have uncovered evidence of 19 giant Cascadia quakes in the last 10,000 years.

They can be as big as the Boxing Day quake that struck off the coast of Sumatra on December 26, 2004. The quake unzipped a 1,300-kilometre subduction zone under the sea floor, generating killer waves that took more than a quarter of a million lives in 14 countries.

The world has learned plenty since [the Sumatra disaster](#), but experts and auditors say Canada still has a way to go.

"Overall the province (British Columbia) is still at a significant risk if a catastrophic earthquake were to occur today," states the damning auditor general's report released in March.

BRACING FOR THE BIG ONE

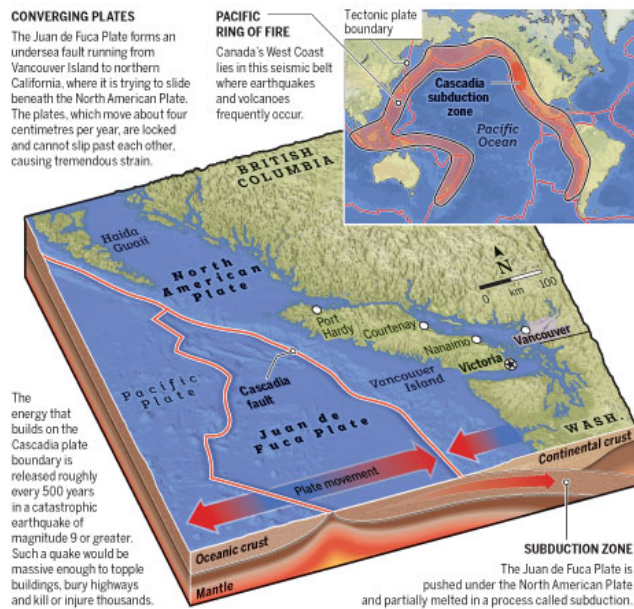
Geologists say it is inevitable that B.C. will experience an immense earthquake comparable to ones that spawned deadly tsunamis in the Indian Ocean in 2004 and Japan in 2011. Canada's West Coast lies on the 1,000-kilometre Cascadia subduction zone where vast slabs of the Earth's crust — called tectonic plates — collide and are trying to slide past each other but are now stuck and building pressure.

CONVERGING PLATES

The Juan de Fuca Plate forms an undersea fault running from Vancouver Island to northern California, where it is trying to slide beneath the North American Plate. The plates, which move about four centimetres per year, are locked and cannot slip past each other, causing tremendous strain.

PACIFIC RING OF FIRE

Canada's West Coast lies in this seismic belt where earthquakes and volcanoes frequently occur.



The energy that builds on the Cascadia plate boundary is released roughly every 500 years in a catastrophic earthquake of magnitude 9 or greater. Such a quake would be massive enough to topple buildings, bury highways and kill or injure thousands.

SUBDUCTION ZONE

The Juan de Fuca Plate is pushed under the North American Plate and partially melted in a process called subduction.

SOURCE: NATURAL RESOURCES CANADA, U.S. GEOLOGICAL SURVEY

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It said the Emergency Management BC, the provincial agency responsible for leading the response to catastrophes, has not made it a priority to come up with comprehensive plans to deal with a catastrophic quake and tsunami and ensure as many people as possible are out of harm's way.

The auditor found "critical gaps" in areas such as earthquake response plans and procedures, training exercises and public education programs and oversight of stakeholder readiness and capacity.

John Clague, a quake expert at Simon Fraser University, agrees B.C. could and should do more.

"We should be as well prepared as Japan," says Clague, noting how Canada is also lagging in key areas such as mapping areas most threatened by tsunamis and "seismic microzonation" to that can identify pockets within cities and districts that can be up to five times more prone to shaking, liquefaction and damage.

Small quakes regularly rattle the west coast, but megathrust quakes are a different beast. Cascadia's subduction quakes are huge — magnitude 9 or more. The [last one](#) struck Jan. 26, 1700, creating a tsunami that destroyed First Nations villages and swept across the Pacific causing damage in Japan.

There is no predicting when the next one will strike. But experts say there is a 12% probability a Cascadia megathrust earthquake will hit in the next 50 years.

Because the Pacific Northwest coast is not heavily populated, a Cascadia quake and tsunami is not expected to be as deadly as the Sumatra quake.

But it will be a major disaster. Emergency planners in B.C. and the U.S. [estimate](#) the number of deaths could exceed 10,000 with another 30,000 people injured. Communities on the west coast of Vancouver Island and the U.S. states will be hit hardest, but aging buildings and infrastructure in Victoria, Vancouver, Seattle and Portland are also at risk of damage and collapse.

The economic impacts are expected to be far-reaching with damage from a Cascadia quake and tsunami expected to cost Canada up to \$75 billion — almost twice B.C.'s annual provincial budget — and another \$70 billion in the U.S.

The B.C. government responded to the damning auditor's report saying it is making "catastrophic earthquake preparedness" a priority, and it is working on a "multi-year roadmap" to enhance preparedness.

When it comes to reducing the death toll experts say quick thinking and response will be critical, especially on the west coast of Vancouver Island where the tsunami poses the biggest threat.

"In some places there will be maybe 20 minutes before the wave hits," says Garry Rogers, a senior research scientist at the federal Pacific Geoscience Centre outside Victoria, where he and his colleagues monitor seismic activity and measure the geological forces building offshore.

Coastal communities, fish farms, resorts and logging operations could be devastated by the metres-high tsunamis that crash ashore and race up inlets.

People will need to know how to get to higher ground and quickly. There will be no time to "collect your favorite pictures, maybe not even your dog," says Clague.

Millions of tourists flock to Vancouver Island every year, and visitors at seaside resorts and campgrounds in Tofino and [Pacific Rim National Park](#) will have no time to dither when the quake hits and the ground starts shaking so hard it will be impossible to stand or walk for several minutes.

Rogers suggests tsunami notices and evacuation routes should be posted on the back of hotel-room doors. "Like the fire escape notice," he says.

While Canada has done some tsunami modelling Rogers and Clague say more detailed analysis is needed to figure out where the giant waves could do the most damage – identifying inlets and channels that could amplify five-metre tsunamis into 15-metre walls of water. And how the waves may slosh around and create powerful currents between the Gulf Islands as the tsunami funnels around Vancouver Island.

"There is a very clearly defined set of tsunami problems that need to be solved," says Rogers.

He points to the proactive work done by the state of Oregon, which has mapped tsunami inundation zones in detail, enabling communities to better plan evacuation routes, identify and create safe havens people can run to, and devise ways to reinforce coastal highway bridges to withstand a tsunami. "The gold standard is what was done in Oregon and that's what we should aim for," says Rogers.

Researchers would also like to get a better read on how the strain is building offshore where the tectonic plates collide and are now locked.

Evidence left by previous quakes suggests Cascadia tsunamis are between five to 10 metres high – "probably closer to five metres," says Rogers. While 5-metre waves can do plenty of damage, they are a fraction the size of the 40-metre monsters generated by the Tōhoku quake off the coast of Japan in 2011. Those wave crippled ports, destroyed thousands of homes and buildings and triggered a nuclear reactor meltdown.

Rogers say it appears "extremely unlikely" Cascadia's subduction zone could generate such huge tsunamis. But he says more detailed assessment is needed to rule out the possibility.

GPS stations on land have enabled the scientists to measure the way Vancouver Island is being tilted and squeezed as the geological strain builds – findings that have led to revisions of the building code to try ensure new west coast homes and high rises are built to withstand quakes.

The scientists want to place sensors on the seafloor along the Cascadian fault – like the Japanese have done off their coast – to better estimate tsunami wave heights.

"We know the on-land measurements, but we don't what is happening under the water," says Rogers. "That is the important part for tsunamis."

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