

Discovery of 72-kilometer fault line on Canada's Vancouver Island

December 12 2023, by Bob Yirka



(a) GoogleTM satellite image of the suburban region on Saanich Peninsula with the trace of the Quaternary scarp on the XELF as a reference. (b) Same extent as (a) showing surficial geology overlain on hillshaded digital terrain model showing the Quaternary scarp crosscutting the drumlinoid ridge. The Eagle Beach trench and electrical resistivity tomography survey locations are shown by black line and the locations of topographic profiles 1 and 2 in (c) are shown by red lines at P1 and P2. (c) Topographic profiles across the Quaternary scarp at locations P1 and P2 on (b) with vertical separation calculated with Monte Carlo

simulations using different surface regressions above and below the scarp, and different fault locations. Credit: *Tectonics* (2023). DOI: 10.1029/2023TC008170

A team of geologists, mineralogists and Earth and ocean scientists affiliated with institutions in Canada, the U.S. and France has discovered a 72-kilometer fault line on Canada's Vancouver Island. In their project, [reported](#) in the journal *Tectonics*, the group discovered the fault line after finding evidence of an earthquake on the Saanich Peninsula thousands of years ago.

Earth scientists have long suspected that parts of the Georgia Basin in Canada has a seismic history. But evidence of earthquakes has been difficult to find due to the [forest cover](#) in the region. In this new effort, the researchers conducted analysis of historical imagery, conducted [remote sensing](#), hiked through forests and conducted shallow geophysical surveys to learn more about the possible seismic history of the Saanich Peninsula, which is situated on the southeastern part of Vancouver Island.

Part of their effort included digging trenches for clues, which led them to find minerals in rock that suggested magnetic field changes over time—an indication of rock formations that were broken or pulled apart and strong evidence of a [fault line](#). In continuing to study such formations, they found further evidence of a fault line that ran for approximately 72 kilometers.

Additionally, study of the fault line showed it to be of the reverse dip-slip kind, where blocks of rock move up and down against each other, rather than the side-to-side sliding that occurs in other fault lines. The research team named it the XEOLXELEK-Elk Lake Fault, and noted that it runs diagonally (northwest to southeast) along the Saanich

Peninsula north of Victoria.

The researchers also note that should an earthquake occur at the site, it is likely that it would generate a tsunami because the fault line passes under the Saanich Inlet. Such a tsunami could strike places in Canada, such as Victoria and Vancouver, and places in the U.S. such as Seattle, Bellingham, Olympia and Tacoma. They also note that it is impossible to tell how soon an [earthquake](#) might strike the region, but note that evidence they gathered suggested the last one was approximately 2,300 to 4,700 years ago and that it was likely between magnitude 6.1 and 7.6.

More information: Nicolas Harrichhausen et al, Discovery of an Active Forearc Fault in an Urban Region: Holocene Rupture on the XEOLXELEK-Elk Lake Fault, Victoria, British Columbia, Canada, *Tectonics* (2023). [DOI: 10.1029/2023TC008170](https://doi.org/10.1029/2023TC008170)

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