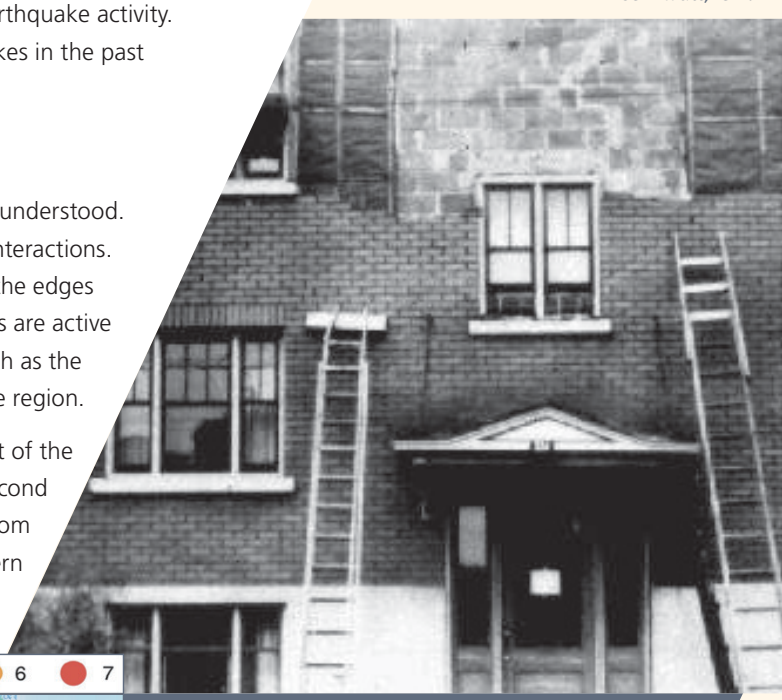
Earthquakes in southeastern Canada

Southeastern Canada regularly experiences low to moderate earthquake activity. The region has also experienced large and destructive earthquakes in the past and will likely experience them in the future.

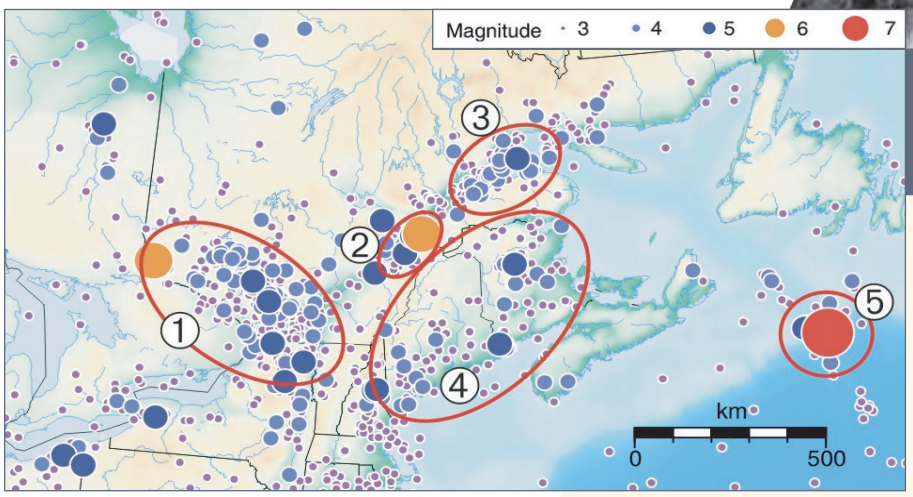
What triggers earthquakes here?

The causes of earthquakes in southeastern Canada are not well understood. In plate boundary regions, seismic activity is the result of plate interactions. However, eastern Canada is hundreds of kilometres away from the edges of the North American Plate. Current theory suggests two forces are active here and re-activating old faults and old zones of weakness (such as the St. Lawrence Valley) causing earthquakes in this otherwise stable region.

The first force acting on the region is due to the slow movement of the North American Plate away from the Mid-Atlantic Ridge. The second force is due to postglacial rebound – the recovery of the plate from the weight of the kilometre-thick sheet of ice that covered eastern Canada 10,000 years ago.



M5.8 1944 Cornwall, ON.



Zones of earthquake activity. This map shows the distribution pattern of earthquakes M3 or greater between 1900 - 2004.

Which areas are the most active?

Earthquakes occur throughout southeastern Canada, but years of recordings have identified five zones with greater earthquake activity. In these zones, earthquakes occur from near the surface to depths of 30 kilometres. Most occur faults that never reach the Earth's surface. The five zones are: 1. West Quebec, 2. Charlevoix-Kamouraska, 3. Lower St. Lawrence, 4. Northern Appalachians, and 5. Laurentian Slope.

How often do earthquakes happen?

Seismologists locate more than 600 earthquakes in southeastern Canada each year. Most of these earthquakes are too small or too remote to be noticed by people. Only about 25 earthquakes a year are felt by people in this region. Approximately three earthquakes capable of causing structural damage happen every decade. These earthquakes are typically greater than magnitude 5 (M5).

The Natural Resources Canada seismograph network detects all events exceeding M3 in eastern Canada. In densely populated areas, where there are more seismological instruments in place, the network detects all events M2 or greater.

A landslide triggered by the 2010 Val-des-Bois earthquake.

1. West Quebec - This area includes Montreal and extends northwest, across the Ottawa River to eastern Ontario. Some notable earthquakes in this area include - the Timiskaming, Quebec magnitude M6.2 earthquake of 1935, which was felt over an area of one million square kilometres; and the Cornwall, Ontario M5.8 earthquake of 1944 which caused almost 26 million 2009 dollars worth of damage. Recent moderate earthquakes in this region include a M4.7 near Timiskaming in 2000; a M5.1 near Plattsburgh, New York in 2002; and a M5.0 near Val-des-Bois, Quebec in 2010. Each of these events caused some damage in their immediate vicinities and were widely felt in southern Ontario and Quebec.

2. Charlevoix-Kamouraska - 100 kilometres downstream from Quebec City centred on the St. Lawrence Valley is the most seismically active region in southeastern Canada. At least five M6 earthquakes have occured here in the past 350 years alone. In 1925, a M6.2 earthquake occurred near La Malbaie, causing extensive damage to the communities along the banks of the St. Lawrence River, Quebec City and Shawinigan. Unreinforced masonry buildings suffered the most damage and many chimneys collapsed. A M5.3 earthquake in March 2005 was felt throughout much of southeastern Canada but did no damage.

Damage in Shawinigan, 1925.

3. Lower St. Lawrence - Although there is no evidence of a large earthquake in the past, the region at the mouth of the St. Lawrence River experiences continuing moderate earthquake activity. The largest event recorded to date (M5.1) occurred in March 1999.

4. Northern Appalachians - This area includes most of New Brunswick and some of New England. A series of significant earthquakes have occurred here, including a M5.7 in the Miramichi area of central New Brunswick in 1982.

Buildings in Lord's Cove, Newfoundland tossed and smashed by the tsunami, 1929.

5. Laurentian Slope - This is an area off Canada's east coast, 250 kilometres south of Newfoundland. In 1929, a M7.2 earthquake here triggered a huge underwater landslide in the Atlantic Ocean. The landslide generated a tsunami which killed 28 people on Newfoundland's Burin Peninsula. This is one of the few recorded earthquakes which caused deaths in what is now Canada (Newfoundland did not join Confederation until 1949). This earthquake is also known as the "Grand Banks" Earthquake, even though it occurred west of the Grand Banks fishing region.

Significant Events Outside Recognized Zones

In 1988, one of eastern Canada's largest earthquakes occurred in the Saguenay region of Quebec, south of Chicoutimi. This M5.9 event caused tens of millions of dollars in damage, even though no buildings or bridges collapsed. The damage was most severe in areas with unstable soil conditions.

In November 1997, another significant event (M5.2) occurred about 15 kilometres west of Quebec City. Minor damage occurred in the area around the epicentre.

Former Montreal-East City Hall suffered damage to the masonry cladding, 1988.

Government of Canada earthquake monitoring and research 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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