

CHAPTER 17

Part 1 of 2

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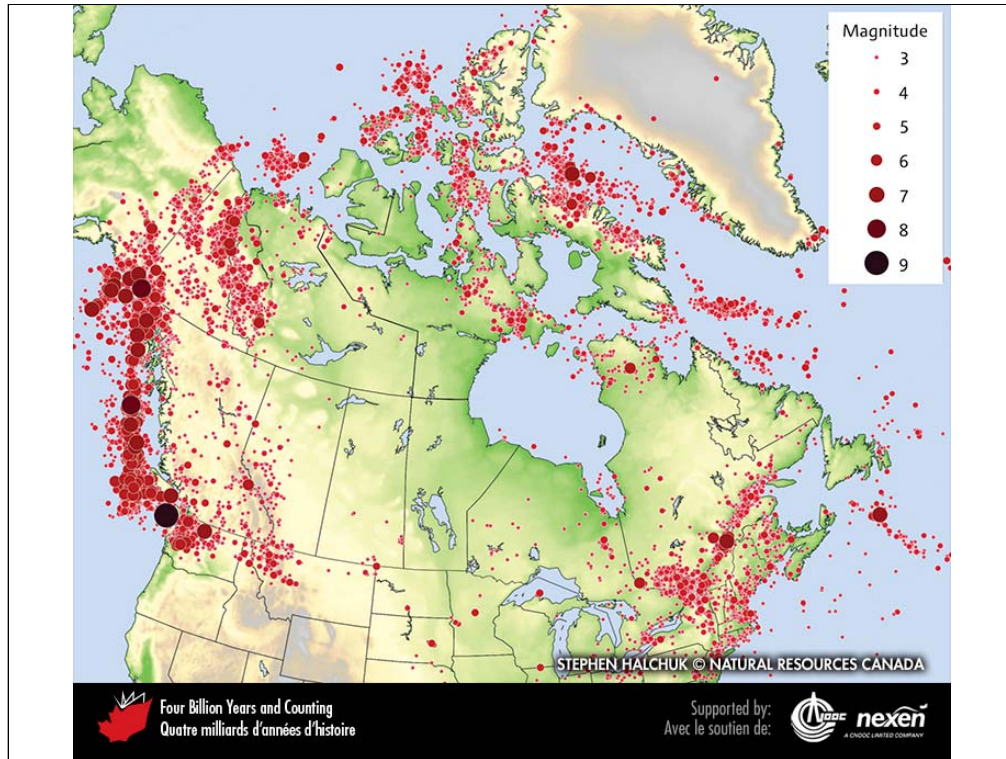
Practically every year at least one part of Canada is affected by serious flooding. The Red River Valley in southern Manitoba is a particularly vulnerable area. During winter, heavy snow tends to accumulate upstream, leading to the possibility of devastating floods downstream during spring melt. The city of Winnipeg is protected from the worst impact of the “Red Sea” floods by the Red River Floodway, which channels peak flows around the city. RON GARNETT / AIRSCAPES.CA.

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The scar on Turtle Mountain and the debris field of the Frank Slide, southwestern Alberta. The debris lobe is now crossed by a highway and a railway. RAY PRICE.

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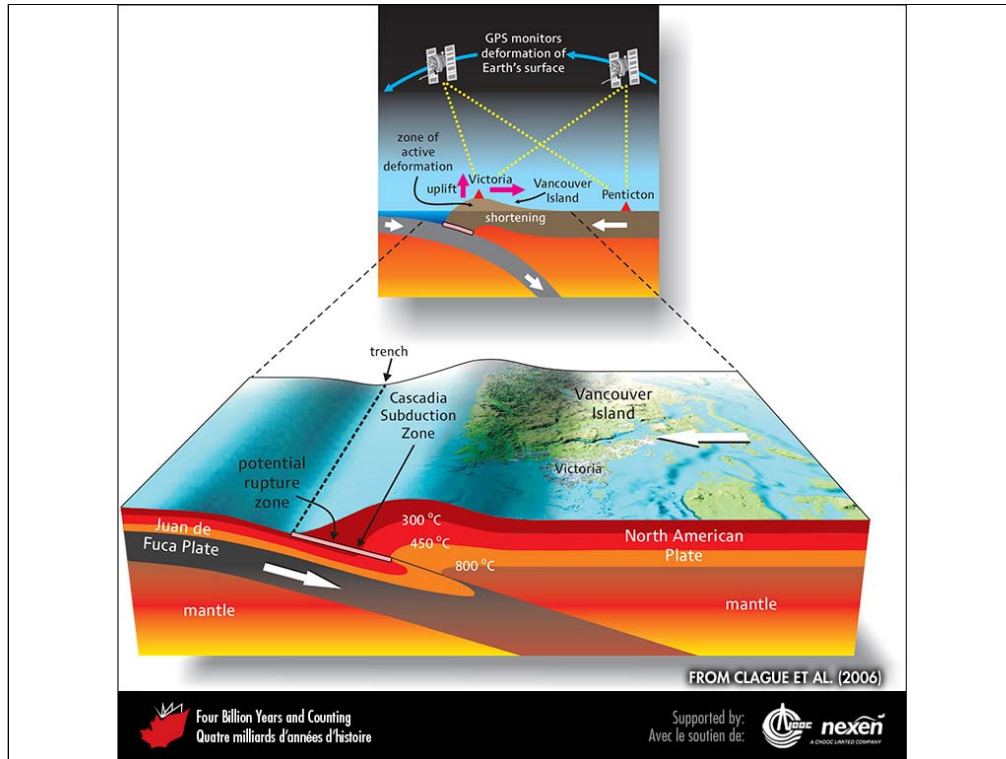
Distribution of earthquakes larger than magnitude 2.5 in Canada. IMAGE COURTESY OF STEPHEN HALCHUK, GEOLOGICAL SURVEY OF CANADA (NATURAL RESOURCES CANADA).

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A building that collapsed during the Kobe earthquake in Japan in January 1995. COURTESY OF THE UNITED STATES GEOLOGICAL SURVEY.

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The oceanic Juan de Fuca Plate is presently locked to the North American Plate where the temperature of the crust along the Cascadia Subduction Zone is less than 350°C. This locked region is where the next great Cascadia earthquake will be initiated. The 450°C isotherm delineates the landward limit of potential rupture; at higher temperatures the rocks are too ductile to break. Vancouver Island is being flexed upward due to compression and elastic shortening of the North American Plate above the locked interface. This deformation has been detected from satellite measurements of small changes in the relative position of points on the Earth's surface. Sometime within the next several hundred years the plates will suddenly unlock, triggering a great earthquake. FROM CLAGUE ET AL. (2006), USED WITH PERMISSION OF THE AUTHORS AND TRICOUNI PRESS.

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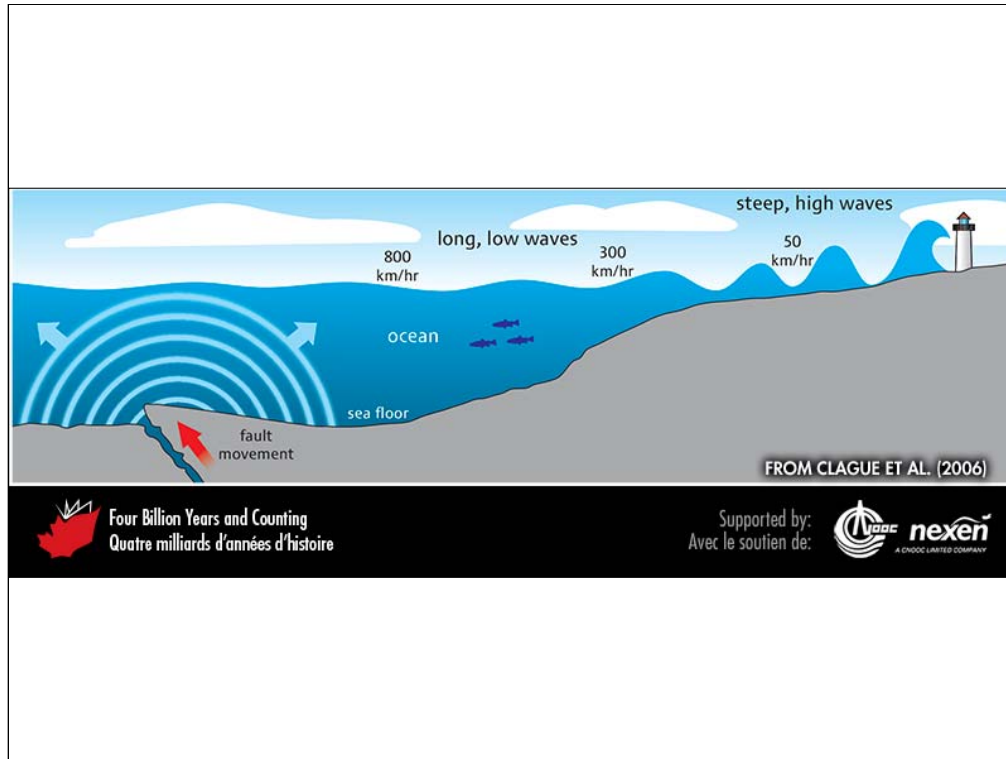
This section dug into a tidal marsh near Tofino, British Columbia, provides evidence for past earthquakes in the region. The tip of the knife is at the top of a buried marsh surface, which is in turn overlain by about 10 centimetres of tsunami-deposited sand. This and other evidence show that the marsh subsided and was inundated by a tsunami during the last great earthquake at the Cascadia Subduction Zone in January 1700. JOHN CLAGUE.

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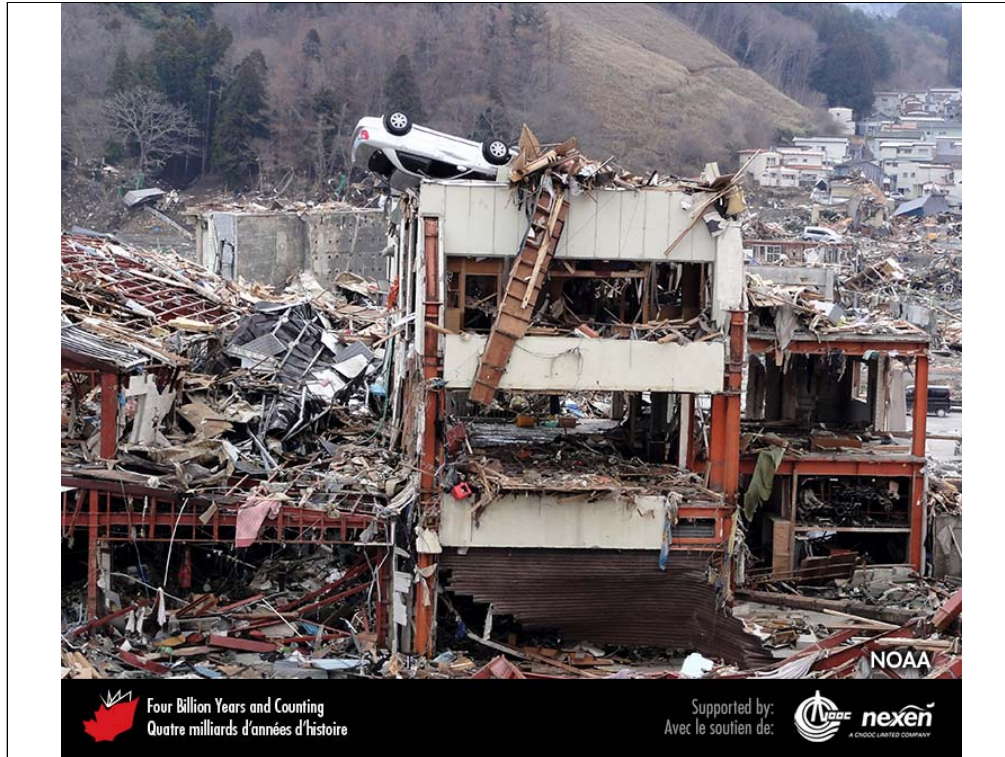
Strong shaking during earthquakes can liquefy loose, water-saturated sediments, as in Christchurch, New Zealand, during the February 2011 earthquake. COURTESY OF NOAA.

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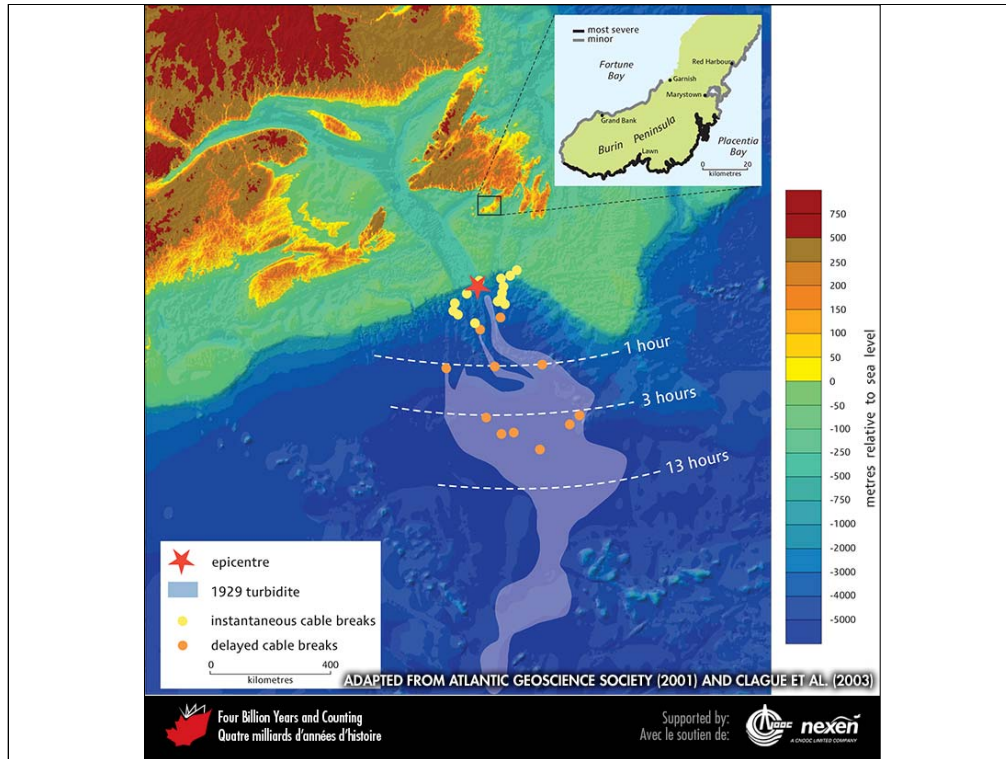
A tsunami can be triggered by rupture of the sea floor along a fault during an earthquake. The sudden upward displacement of the sea floor produces tsunami, which often have a deadly impact when they reach shore. The values in kilometres-per-hour show how much a tsunami loses speed as it moves shoreward. FROM CLAGUE ET AL. (2006), USED WITH PERMISSION OF THE AUTHORS AND TRICOUNI PRESS.

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Destruction wrought by the 2010 earthquake and tsunami on the Oshika Peninsula, northeastern Japan. COURTESY OF NOAA.

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The extent of the turbidity current deposit associated with the Grand Banks Earthquake of November 1929, and the timing of breaks to submarine cables caused by the powerful bottom current. The inset shows the parts of the Newfoundland coastline affected by the tsunami generated by this earthquake. The terms “most severe” and “minor” refer to physical damage to docks, wharves, boats, and buildings. MAIN FIGURE FROM ATLANTIC GEOSCIENCE SOCIETY (2001); INSET ADAPTED FROM CLAGUE ET AL. (2003).

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The crater in the Tseax Cone, which erupted around 1775, producing an explosive pyrotechnics show, is vividly remembered in Nisga'a oral history. The Tseax Cone and its associated lavas are part of the Stikine Volcanic Belt in northern British Columbia. CATHERINE HICKSON.

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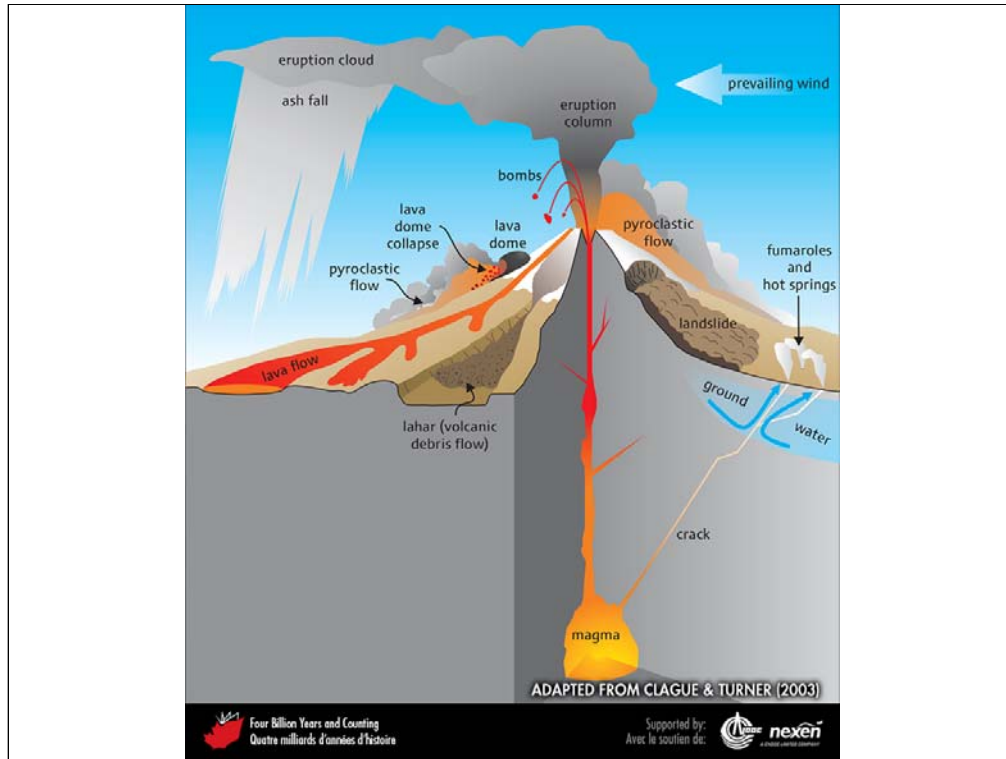
Part 2 of 2

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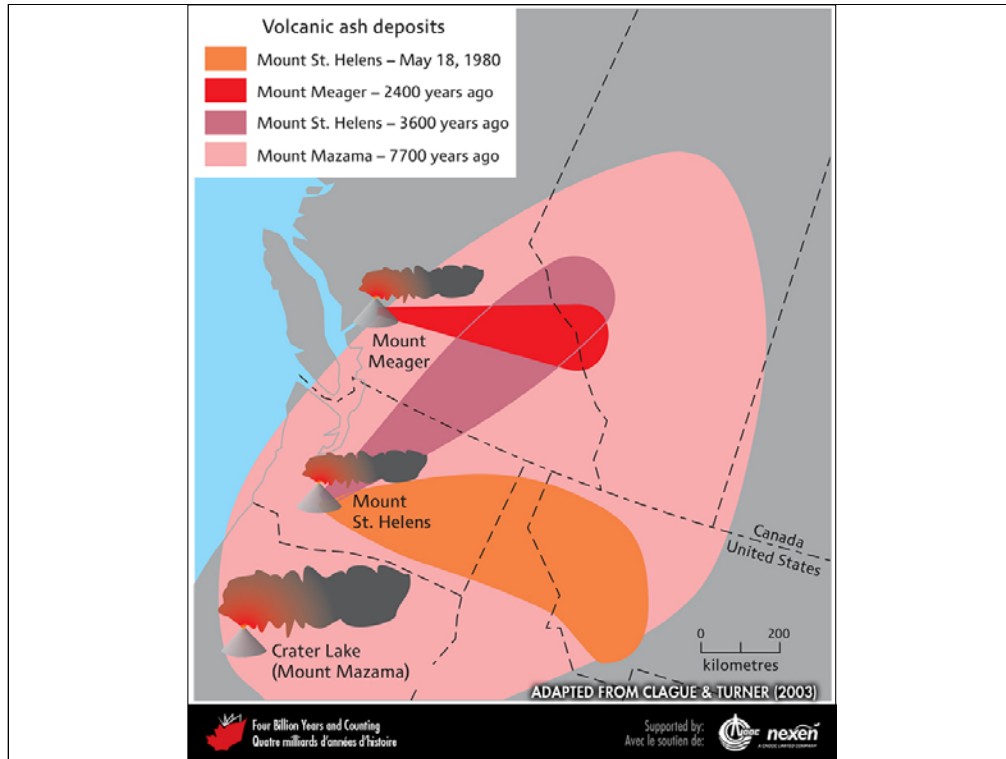
Seen here from Saturna Island, British Columbia, Mount Baker in Washington is an active volcano, one of many in the Cascade Magmatic Arc. The Arc extends into southwestern British Columbia and includes mounts Garibaldi and Meager. C. CHEADLE, COPYRIGHT PARKS CANADA.

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Types of hazards associated with explosive eruptions of stratovolcanoes such as Mount Garibaldi and Mount Meager. Fumaroles are surface openings that emit steam and other gases such as sulphur dioxide and carbon dioxide. ADAPTED FROM CLAGUE AND TURNER (2003); USED WITH PERMISSION OF THE AUTHORS AND TRICOUNI PRESS.

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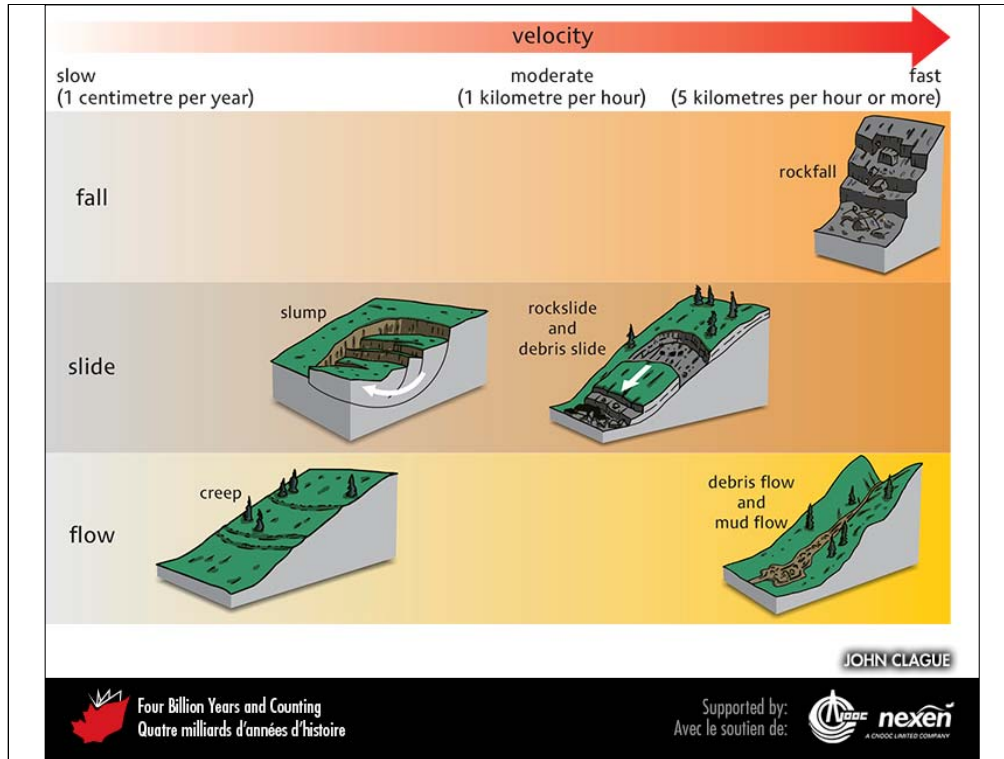
Ash deposits associated with selected volcanic eruptions from Cascade volcanoes. The illustration shows only areas where the ash deposits are thick enough to be visible. ADAPTED FROM CLAGUE AND TURNER (2003); USED WITH PERMISSION OF THE AUTHORS AND TRICOUNI PRESS.

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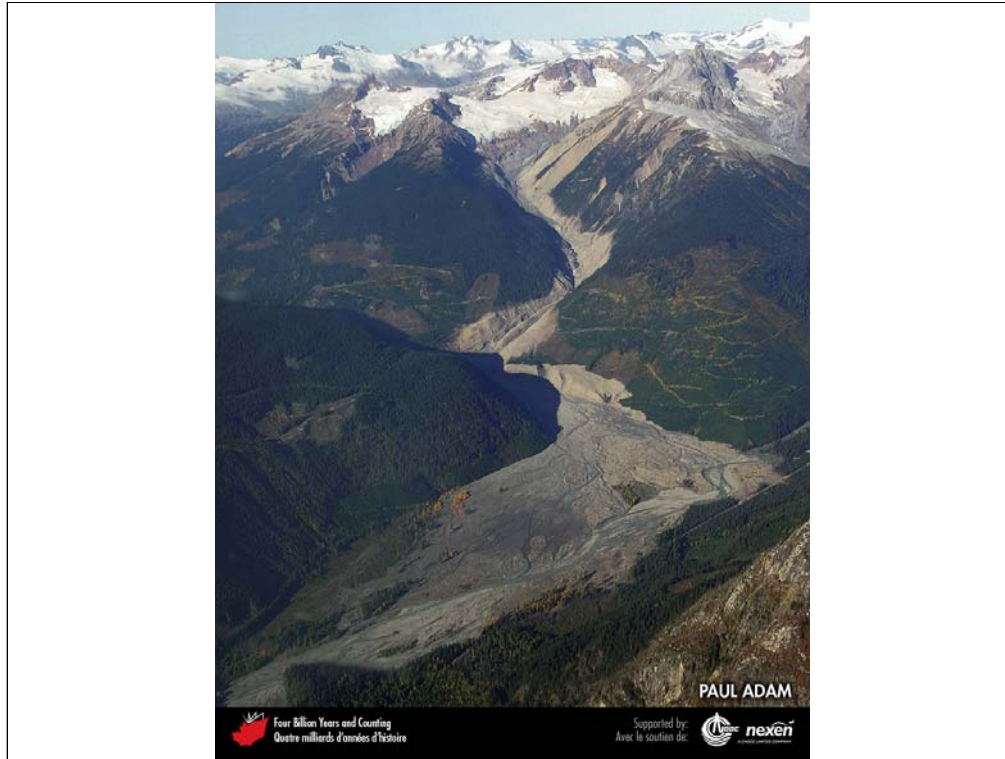
Exposed in a road cut along Highway 3 near Keremeos, British Columbia, the white layer is volcanic ash from the eruption of Mount Mazama in Oregon, 7,700 years ago. DALE GREGORY.

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Types of landslides. Landslides are classified according to type of movement (fall, slide, or flow); type of material that fails (i.e., rock or unconsolidated sediment); amount of water or air involved in the movement; and velocity.

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Large landslide resulting from the collapse of the south flank of Mount Meager, British Columbia, in August 2010. PAUL ADAM.

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Landslide south of Lytton, British Columbia, in March 1997. The landslide severed the Canadian National Railway line, causing a freight train to derail with the loss of two lives. JOHN CLAGUE.

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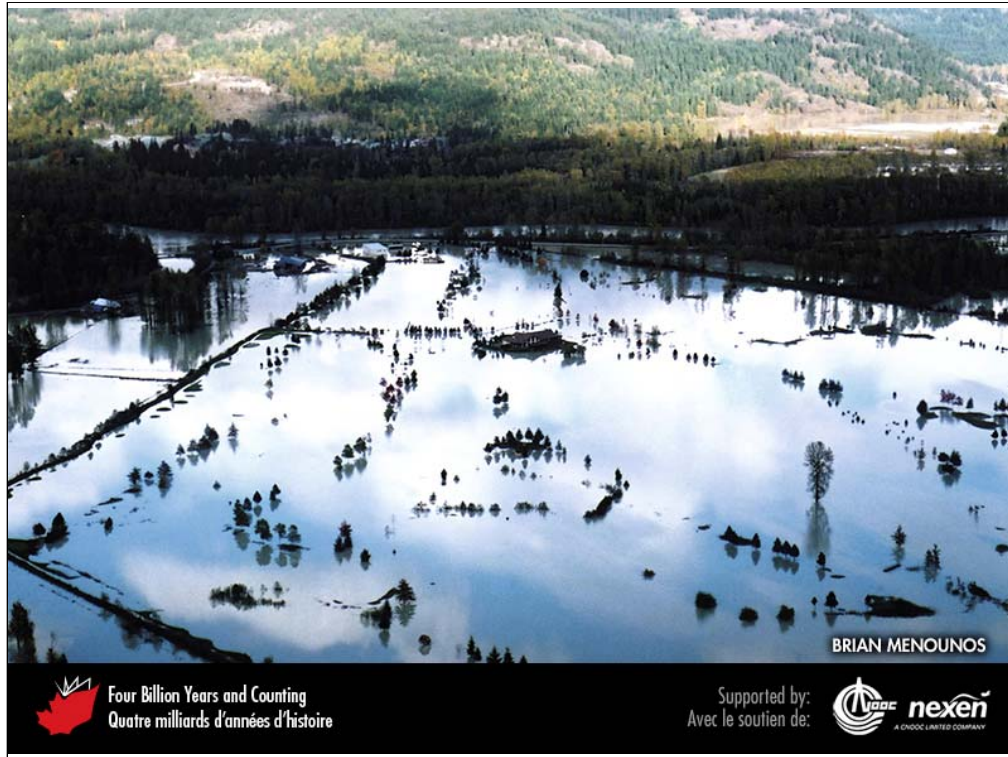
The 1993 Lemieux Landslide in the valley of the South Nation River, Ontario. Such landslides resulting from the sudden liquefaction of Leda Clay, a deposit of the Champlain Sea. GREG BROOKS, REPRODUCED WITH THE PERMISSION OF NATURAL RESOURCES CANADA 2013, COURTESY OF THE GEOLOGICAL SURVEY OF CANADA.

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The town of Morris, Manitoba, surrounded by floodwaters during the 1997 Red River flood. Although it resembles an island, the ground surface in Morris is lower than the level of the water; a ring dyke around the town prevents it from being inundated. GREG BROOKS.

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Flooding in the Lillooet River valley at Pemberton, British Columbia, in October 2003.
BRIAN MENOUNOS.

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Damage caused by the devastating Saguenay flood in Quebec in July 1996. Waters overflowing the Jonquière Dam on Rivière aux Sables produced a breach about 20 metres wide within the concrete wing of the dam, thereby lowering the reservoir by several metres. Flood waters also severely damaged the powerhouse immediately downstream. GREG BROOKS.

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