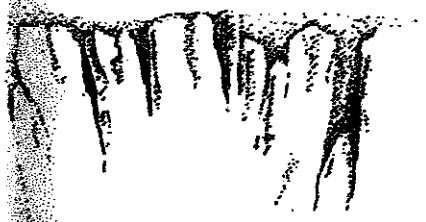
Puget Sound. It was the action of ice and its later meltwaters that gave shape to the landscapes of today.

Though often called the "Ice Age," the Pleistocene was not one period during which the land was continuously covered with ice. Many advances and retreats of continental glaciers are recorded by the repeated scourings and deposits of rock-laden glaciers.

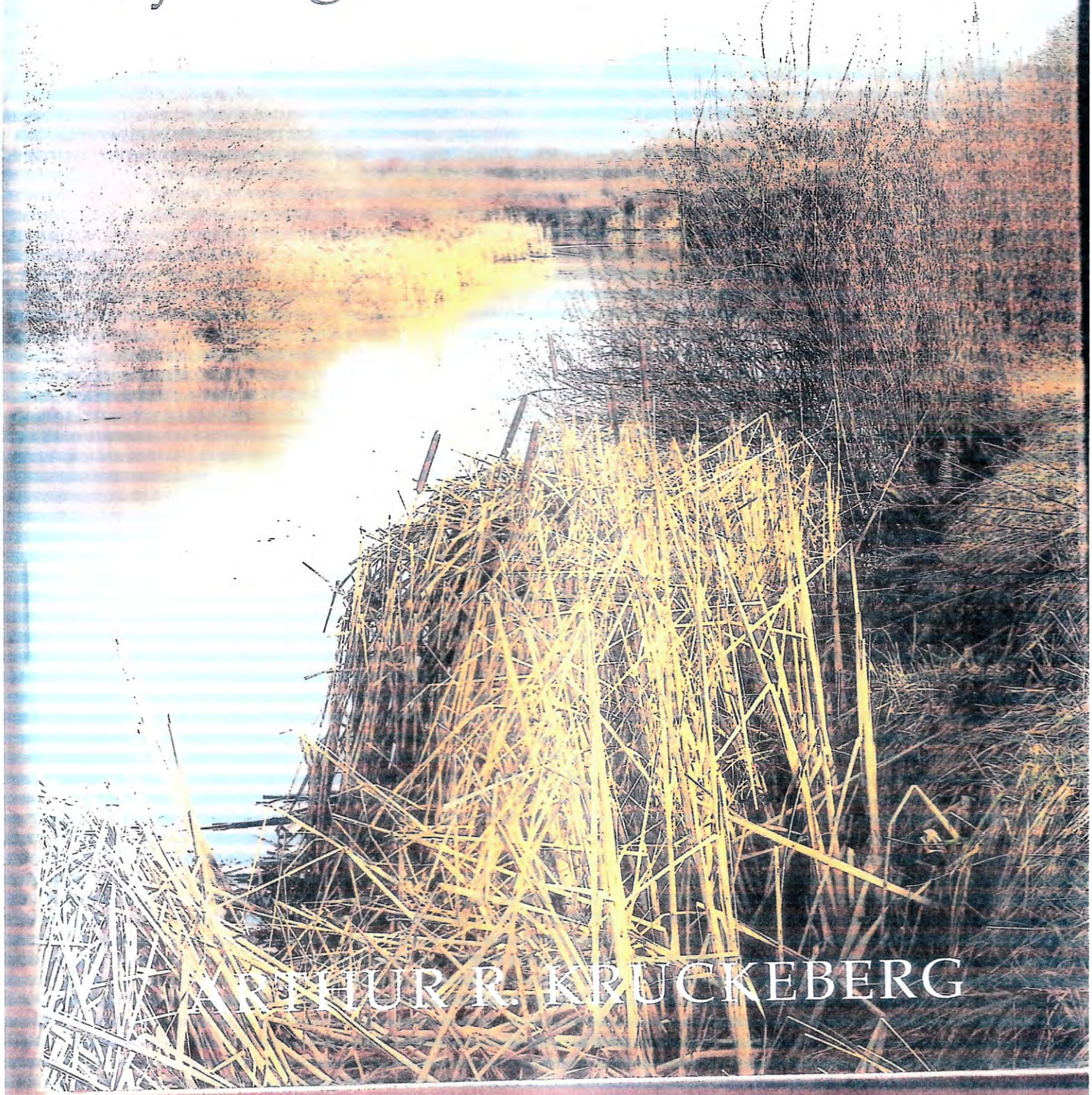


The Fraser Glaciation was the latest of the major advances of northern ice into western Washington. Yet Washington and the Pacific Northwest were not alone in having endured repeated interludes of icy inundation. It was a time of repeated ice advances and retreats on the northern continents of our restless planet. The Pleistocene epoch, beginning about 2.2 million years ago, made a telling impression worldwide but especially on the northern parts of North America and Eurasia. Massive continental glaciers spread out over northern lands until a confluent mass of ice, two to seven thousand feet thick, covered vast landscapes.

Each glacial advance and retreat (a stade) was followed by a warmer interglacial period. During interglacials, montane glaciers, which were much reduced during continental ice maxima, extended themselves, often overriding continental ice deposits as

(Xavier) w/Attachment 14

The Natural History of Puget Sound Country



ARTHUR R. KRUCKEBERG

Xayer Attachment 15

Partial list of earthquakes – some references are included in the main letter.

The west coast of the U.S. if geologically volatile. To the west of us is the Cascadia Subduction Zone which stretches from the northern tip of Vancouver Island to the upper 1/3 of California. There's a 37 % chance of an 8.2+ magnitude earthquake within 50 years, and a 10-15% chance that the **entire** Cascadia Subduction will rupture with a magnitude 9+ event within the same time frame. To the east of us are about 15 volcanoes looming north-south, running parallel to the subduction zone. In **1700**, there was a quake of around 9.0 – the length of the fault rupture was 620 miles long. It triggered a tsunami affecting Japan. There have been more, large earthquakes in this zone ever since.

Meanwhile:

1949 – an 8.1 quake off the coast of B.C., and another quake in the Olympia area of 7.1.
1965 – a large quake in the Seattle area created a landslide that left railroad tracks hanging in mid-air for quite a distance.
1970 – a 7.4 south of Haida Gwaii.
1990 – a 5.2 near Deming.
1997 – a small down slope movement on the Sumas fault broke a gas pipeline, resulting in an explosion and fire.
2000 – a report is written about 2 major earthquake faults, running diagonally east-west & parallel to each other between Bellingham and the Canadian border – they cross I-5 and the railroad tracks and extend beyond Deming.
Sept. 9, 2011 – 6.4 magnitude earthquake off Vancouver Island.
April, 2012 – geologists have discovered 2 more earthquake faults, possibly a 3rd, in the lowlands north of Bellingham.
October 27, 2012 – 7.7 quake near Queen Charlotte Is. off B.C.
October 28, 2012 – 3.3 quake near Los Angeles
October 30, 2012 – 6.6 quake again near Queen Charlotte Is.
Recently, 1-4-2013 – a 7.5 west of Craig, Alaska.

Reports indicate that more than 500 quakes of 2 or greater occurred in Whatcom, Skagit, and San Juan counties, between 1969 and 1993. Ten historic quakes of 4 – 7.4 occurred between 1872 and 1969. The region near Deming is among the most active earthquake zones in the state with hundreds of quakes since 1969.

Xayer Attachment 16

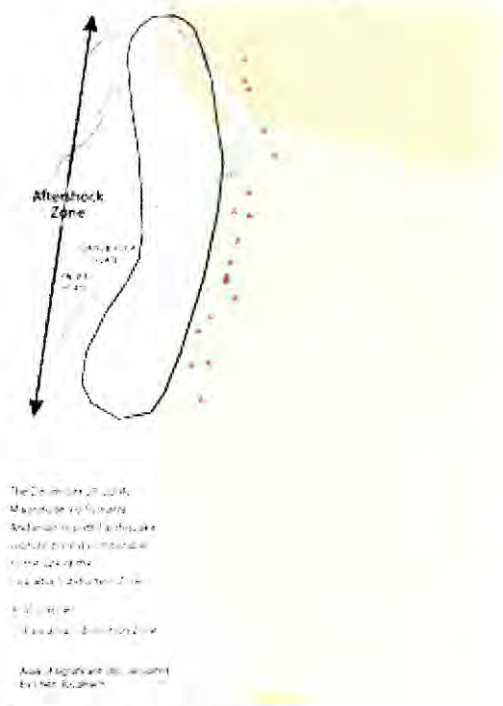
(We are a few miles to the east of this.)

1700 Cascadia earthquake

From Wikipedia, the free encyclopedia

The **1700 Cascadia earthquake** was a magnitude 8.7 to 9.2 megathrust earthquake that occurred in the Cascadia subduction zone on January 26, 1700.[1] The earthquake involved the Juan de Fuca Plate underlying the Pacific Ocean, from mid-Vancouver Island in British Columbia, Canada, south along the Pacific Northwest coast as far as northern California, USA. The length of the fault rupture was about 1,000 kilometers (620 miles) with an average slip of 20 meters (22 yards).

The earthquake caused a tsunami that struck the coast of Japan,[2] and may also be linked to the Bonneville Slide.[3]



Cascadia subduction zone

Contents

Evidence of the earthquake

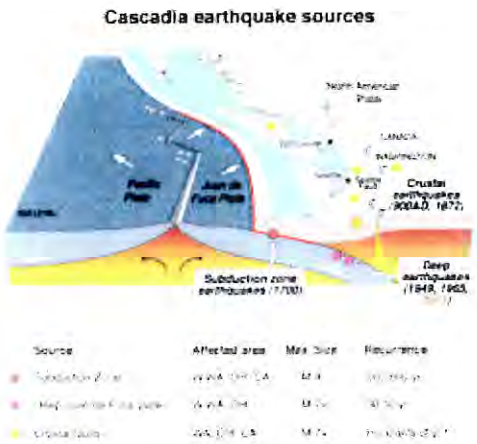
Evidence supporting the occurrence of the 1700 earthquake has been gathered into the 2005 book *The Orphan Tsunami of 1700*, by geologist Brian Atwater and others.

The evidence suggests that it took place at about 21:00 on January 26, 1700 (NS). Although there were no written records in the region at the time, the earthquake's precise time is nevertheless known from Japanese records of a tsunami that has not been tied to any other Pacific Rim earthquake. The most important clue linking the tsunami in Japan and the earthquake in the Pacific Northwest comes from studies of tree rings (dendrochronology) which show that red cedar trees killed by lowering of coastal forests into the tidal zone by the earthquake have outermost growth rings that formed in 1699, the last growing season before the tsunami. Local Indigenous American oral traditions describing a large quake also exist, although these do not specify the date.[4] There are many areas in the Pacific Northwest with drowned groves of trees that also show evidence of the earthquake.[5]

Future threats

Great Earthquake

Kayser Attachment 17



Cascadia earthquake sources

Summary

est. year	interval (years)
1700 AD	-
1310 AD	390
810 AD	500
400 AD	410
170 BC	570
600 BC	430

The geological record reveals that "great earthquakes" (those with moment magnitude 8 or higher) occur in the Cascadia subduction zone about every 500 years on average, often accompanied by tsunamis. There is evidence of at least 13 events at intervals from about 300 to 900 years with an average of 570—590 years.[6] Previous earthquakes are estimated to have occurred in 1310 AD, 810 AD, 400 AD, 170 BC and 600 BC.

As seen in the 1700 quake, the 2004 Indian Ocean earthquake, and the 2011 Tōhoku earthquake and tsunami, subduction zone earthquakes can cause large tsunamis, and many coastal areas in the region have prepared tsunami evacuation plans in anticipation of a possible future Cascadia earthquake. However, the major nearby cities, notably Seattle, Portland, Vancouver, Victoria, and Tacoma, which are located on inland waterways rather than on the coast, would be sheltered from the full brunt of a tsunami. These cities do have many vulnerable structures, especially bridges and unreinforced brick buildings; consequently, most of the damage to the cities would probably be from the earthquake itself. One expert asserts that buildings in Seattle are vastly inadequate even to withstand an earthquake of the size of the 1906 San Francisco earthquake, much less the much greater one that may well occur.[7]

Recent findings conclude that the Cascadia Subduction zone is more complex and volatile than previously believed. In 2010 geologists predicted a 37 percent chance of an M8.2+ event within 50 years, and a 10 to 15 percent chance that the entire Cascadia Subduction will rupture with an M9+ event within the same time frame.[8] Geologists have also determined the Pacific Northwest is not prepared for such a colossal quake. The tsunami produced could reach heights of 80 to 100 feet (24 to 30 m).[9]

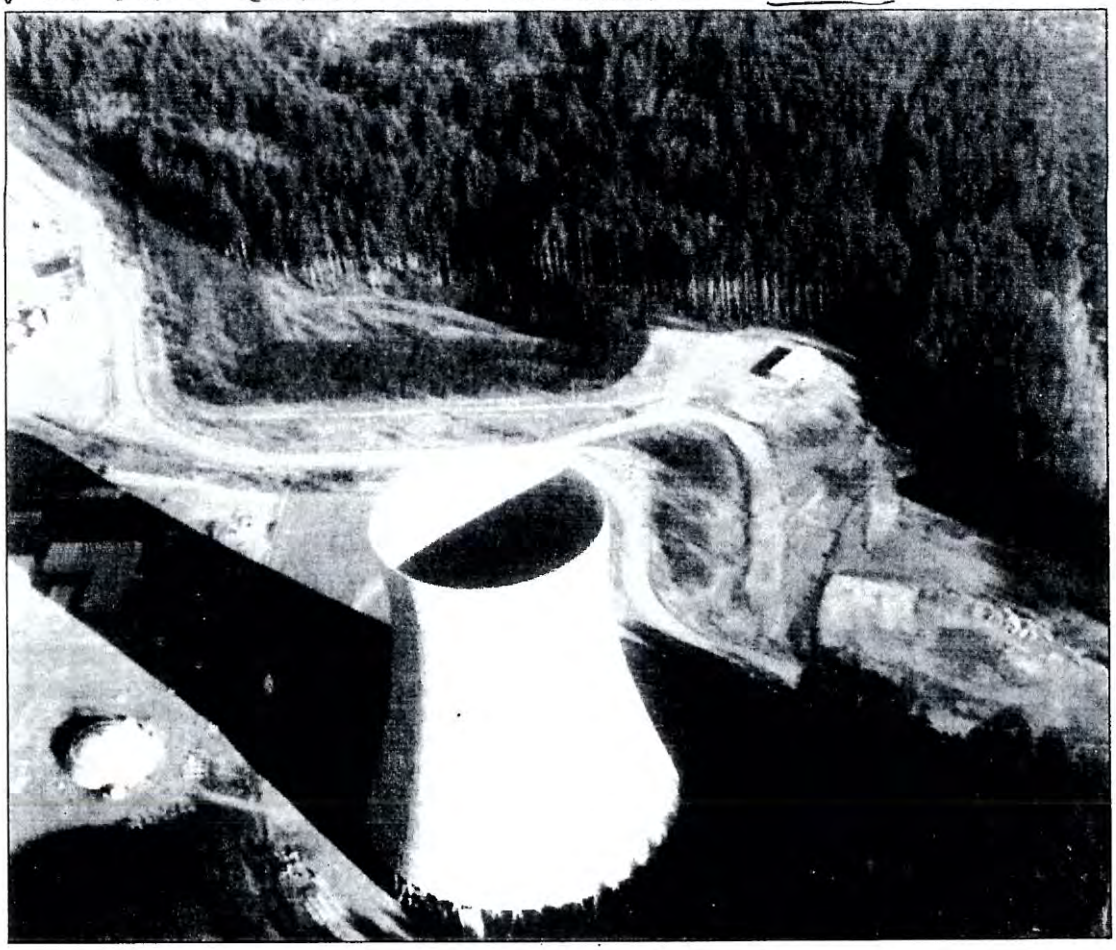
Some other subduction zones have such earthquakes every 100 to 200 years; the longer interval results from slower plate motions. The rate of convergence between the Juan de Fuca Plate and the North American Plate is 60 millimetres (2.4 in) per year.[10]

Similar megathrust earthquakes

Other megathrust earthquakes are the slightly more powerful 1964 Alaskan Good Friday Earthquake measured at moment magnitude 9.2; the 1960 Great Chilean Earthquake measured at 9.5; the Kamchatka earthquakes of 1737 (est. mag. 8.3) and 1952 (measured at 9.0); the 2004 Indian Ocean earthquake at 9.1; the 2010 Chile earthquake at 8.8; and the 2011 Tōhoku earthquake at 9.0.

Xaver Attachment 18

Wa St. DNR Geology Div. Bulletin 80 - 1994



Cooling tower of an unfinished nuclear power plant at Satsop in Grays Harbor County. Recent advances in our understanding of the tectonics and earthquake hazards of the Cascadia Subduction Zone were due at least partially to investigations prompted by (and funded because of) safety concerns at this facility. Photo by Timothy J. Walsh, 1988.