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Seismic Activity in Canada, West of the 113th Meridian 1841 - 1951

BY

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ABSTRACT

From a search of available data, a list of the earthquakes felt or centred in the western mountain region of Canada has been prepared. From December of 1841 to August of 1951, a total of 242 earthquakes were located in this general area. These vary in intensity from very weak shocks to the Queen Charlotte Islands earthquake of magnitude 8·0. A description is given for the major tremors. An additional list contains those tremors recorded at Victoria after the sensitive seismograph was installed in 1948 but for which epicentres could not be determined. A map is included to show the area studied; it does not contain a complete record of the earthquakes.

INTRODUCTION

Seismological study in British Columbia began in 1899 when the first seismograph was installed at Victoria. From that date there has been a seismograph in continuous operation at Victoria, except for a brief period in 1938-39. The original instruments and their later replacements were not designed to record small earthquakes occurring near the station; hence their contribution to studies of the early seismological history of British Columbia is limited. In 1948 a sensitive seismograph was added to the Victoria station, and in 1951 two additional sensitive stations were established in south-western British Columbia for a more detailed investigation of the seismicity of that area.

The data from the network seismographs have been published in other issues of these *Publications*.[1,2,3,4] In order to make the picture as complete as possible, in this publication an attempt is made to list all the tremors occurring from the time of the earliest records in British Columbia to August of 1951. The report includes the earthquakes that have been centred or felt in British Columbia or in its coastal waters, in western Alberta, in the southern Yukon Territory area, and off the coast of the Alaskan panhandle. All available sources of information for compiling such a list have been thoroughly checked, and the results are presented in this paper. If other sources of data that may later become available reveal additional information, a supplementary report will be published.

INSTRUMENTS

Before discussing the earthquakes occurring in British Columbia prior to 1951, it is of interest to record the early history of seismograph stations in the province, a history that is centred about one place, for until 1951 Victoria was the sole seismograph station in British Columbia.

At the suggestion of the British Association for the Advancement of Science, two seismographs were purchased by the Dominion Government Meteorological Service at

[1] W. G. Milne and F. Lombardo, "Canadian West Coast Earthquakes, 1951", *Publications of the Dominion Observatory*, Vol. XVI, No. 3, 1952.
[2] W. G. Milne, "Canadian West Coast Earthquakes, 1952", *Publications of the Dominion Observatory*, Vol. XVI, No. 9, 1954.
[3] W. G. Milne, "Canadian West Coast Earthquakes, 1953", *Publications of the Dominion Observatory*, Vol. XVI, No. 13, 1955.
[4] W. G. Milne, "Canadian West Coast Earthquakes, 1954", *Publications of the Dominion Observatory*, Vol. XVIII, No. 3, 1956.

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Toronto, one of which was installed at Toronto in 1897 and the other at Victoria in the basement of the Customs Building at Government and Humbolt Streets, where it began to operate on January 1, 1899. The Victoria instrument, of the Milne horizontal type, was number ten of the original group of seismographs of this design. The paper speed of the instrument was 250 mm. per hour, the static magnification was quoted as six, and the period was approximately 19 seconds. Needless to say, the recordings of such an instrument could contribute little to the study of small local earthquakes. The instrument was operated by the Meteorological Service under the supervision of Mr. Baynes Reid, and later, of Mr. F. Napier Denison.

In 1907 Mr. Denison designed and put into operation a second similar seismograph, and, in 1914, a Wiechert, 80 kgm., vertical seismograph was added.

In 1916 the Gonzales observatory was built by the Meteorological Service near Ross Bay along the Strait of Juan de Fuca. The three instruments mentioned above were then installed on piers in the basement of the observatory and orientated to record east-west, north-south, and vertical motion. It is told in Victoria that Mr. Denison would amaze visitors to the observatory by showing them that the building moved up and down with the rise and fall of the tides. Certainly the location was not ideal for a tiltmeter-type seismograph. In January 1923 two Milne-Shaw seismographs replaced the original Milne instrument. The latter remains on its pier at the Gonzales observatory as a present-day museum-piece, apparently still in operating condition.

In 1936 the Meteorological Office was placed under the Department of Transport, and as a part of the re-organization, the seismographs were transferred to the Dominion Observatory of the Department of Mines and Resources. However the latter Department had at that time no space available at Victoria for the instruments and their operation continued at the Gonzales observatory. Late in the summer of 1939 a vault was constructed at the Dominion Astrophysical Observatory on Little Saanich Mountain and the instruments were transferred to this location, being out of operation for a few months during the transfer. At the Dominion Astrophysical Observatory the instruments were in charge of one of the astronomers, Dr. K. O. Wright, with the records being studied in Ottawa by members of the Seismological Service of the Dominion Observatory. The use of the Wiechert vertical instrument was discontinued early in 1946, but the two Milne-Shaw seismographs are still in operation. Early in 1948, a short-period vertical Benioff seismograph ($T_s = 1 \cdot 0$ second, $T_g = 0 \cdot 2$ second) was installed, probably as a direct result of interest created by the strong tremor of June 23, 1946. The great number of local earthquakes recorded by this instrument led to the installation in 1951 of two additional stations at Horseshoe Bay (near Vancouver) and at Alberni (on Vancouver Island) to make it possible to compute epicentres. At the same time seismologists were stationed at the Astrophysical Observatory to care for the instruments and to investigate the local seismicity of British Columbia. Two further improvements have been the transfer of the seismographs to a vault in the new office building of the Dominion Astrophysical Observatory, and the addition of the other two components to the vertical Benioff instrument. Complete details of station changes since August, 1951 are contained in the publications noted on page 119.

One of the most important features of any good seismograph station is an accurate time control on the records. It is assumed that prior to 1939, as is known to be the case since that year, time marks were placed on the records from calibrated standard chronometers with good rates. From 1939 to 1948 time signals were received by radio from the CBC radio station, and the chronometer correction was noted daily. Since the installation of the Benioff seismograph in 1948, CBC radio time signals have been automatically recorded daily.

SOURCES OF INFORMATION

Data on earthquakes in western Canada is given in two tables, Table 1 listing located epicentres, Table 2 giving unlocated earthquakes recorded in the Benioff seismograph at Victoria prior to the beginning of the enlarged program in August, 1951. The data for these tables have been gathered from many sources during a period of several years. The publications consulted have been referred to in the following discussion in the order of their use as sources of information. Newspaper files were subsequently checked for additional information on the earthquakes.

The basic source of information was a paper by Townley and Allen[5] containing a catalogue of earthquakes occurring on the Pacific Coast of the United States during the years 1769 to 1928; the chapter entitled "Earthquakes in Washington, 1833 to 1928" was most useful. The authors point out that the information on earthquakes from 1769 to 1897 was taken from a catalogue by Edward S. Holden,[6] published by the Smithsonian Institution of Washington, and that on earthquakes from 1897 to 1906 from a catalogue by Alexander G. McAdie[7] published by the same Institution. Neither of these original catalogues was available to the author. Only the earthquakes that were known to have been centred or felt in British Columbia are included in Tables 1 and 2.

The International Seismological Summary contains an index of epicentres for the years since 1913, and these indexes were searched for earthquakes occurring in the area covered by this report. Many of the epicentres and magnitudes for the years 1904 to 1946 were obtained from Gutenberg and Richters' "Seismicity of the Earth".[8] For the years 1946 to 1951, the cards issued by the United States Coast and Geodetic Survey were used as a source of information for epicentres and magnitudes. Pasadena magnitudes are those usually quoted.

Dr. A. F. Buckham, formerly of the Geological Survey of Canada, generously permitted the author the use of material he had collected. Buckham's early data were obtained from a paper by D. C. Bradford[9] on the seismic history of the Puget Sound Basin up to the year 1934, and Bradford in turn quotes largely from the paper of Townley and Allen, mentioned above. Again only those earthquakes that were centred or felt in British Columbia have been included.

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[5] Sidney D. Townley and Maxwell W. Allen, "Descriptive Catalog of Earthquakes of the Pacific Coast of the United States 1769 to 1928", *Bull. Seism. Soc. Am.*, Vol. 29, No. 1, 1939.

[6] Edward S. Holden, "Catalogue of Earthquakes of the Pacific Coast from 1769 to 1897", *Smithsonian Miscellaneous Collections, No. 1087.*

[7] Alexander G. McAdie, "Catalogue of Earthquakes of the Pacific Coast, from 1897-1906", *Smithsonian Miscellaneous Collections, No. 1721.*

[8] B. Gutenberg and C. F. Ritcher, "Seismicity of the Earth and Associated Phenomena", Princeton University Press, 1949.

[9] D. C. Bradford, "Seismic History of the Puget Sound Basin", *Bull. Seism. Soc. Am.*, Vol. 25, 1935.

F. Napier Denison, while in charge of the seismographs at the Gonzales observatory, clipped from various newspapers many articles on the earthquakes that were recorded at his station. This scrap-book was loaned to the author by the present meteorologist, W. H. Mackie, so that newspaper reference to earthquakes in British Columbia might be included in this report. Dr. E. A. Hodgson, while in charge of the Division of Seismology at the Dominion Observatory, also kept a scrap-book of newspaper articles concerning earthquakes. This has proven very useful as his collection includes articles from many Canadian newspapers. As well, use was made of the file on seismology at the Dominion Astrophysical Observatory, that contains letters and clippings on British Columbia earthquakes, the most important being those relating to the Bella Coola earth tremors from 1940 to 1943.

When the list was complete, each event on it was checked with available British Columbia newspapers for that date to determine to what extent the tremor was felt and reported upon. The Victoria *British Colonist* was the first newspaper in British Columbia, beginning publication in December, 1858, and with the permission of the Provincial Archivist, Willard Ireland, the copies of this newspaper in his files were searched for references to earthquakes in the years 1858 to 1872. Other newspaper files, in the library of the Provincial Parliament Buildings at Victoria, were made available to the author. In addition, a careful search of newspapers was made for each earthquake already listed. One daily newspaper of Victoria and one daily newspaper of Vancouver were consulted for each earthquake, and if they made reference to the event, the newspapers for the surrounding area, both daily and weekly, were scanned for more information. Usually the daily or weekly newspapers of such cities as Nanaimo, Chilliwack and Vernon supplied a great deal of information to add to that obtained from the Victoria and Vancouver newspapers. As well, the earthquakes of the Queen Charlotte Islands were usually mentioned in the Prince Rupert daily papers.

Table 2 contains information on earthquakes recorded on the Benioff vertical seismograph at Victoria. These are all within the distance range of local earthquakes, but there may be many of them whose epicentres are not in British Columbia. With only one sensitive seismograph it is not possible to obtain the location of an epicentre; however in order that the list may be complete all the recorded earthquakes are included.

Other sources of information on local earthquakes are scientific publications discussing the more severe tremors. E. A. Hodgson published an account of the June 23, 1946 tremor,[10] and F. Napier Denison wrote articles on the 1918[11] and 1920[12] earthquakes. Information from all three reports has been used in this compilation.

The author wishes to thank the institutions and persons mentioned above for their assistance in supplying information. It is hoped that the tables are reasonably complete and accurate, but if any reader has additional information pertaining to these or any other British Columbia earthquakes, it would be most gratefully received by the author.

[10] E. A. Hodgson "British Columbia Earthquake, June 23, 1946", *J. Roy. Astron. Soc. Can.*, Vol. 40, 1946.

[11] F. Napier Denison, "The British Columbia Earthquake of December 6, 1918", *Bull. Seism. Soc. Am.*, Vol. 9, 1919.

[12] F. Napier Denison, "The British Columbia Earthquake of January 23, 1920", *Bull. Seism. Soc. Am.*, Vol. 10, 1920.

INTENSITIES OF EARTHQUAKES

In Table 1 the roman numerals immediately following the time of the earthquake are the author's estimation of the intensity near the origin of the tremor. These intensities are related to the Modified Mercalli Intensity Scale of 1931, shown below. In British Columbia it is very difficult to assign an intensity to an earthquake because, particularly for the early tremors, the areas immediately adjacent to the earthquake were quite often uninhabited. Ratings are assigned wherever possible but they may be in error by at least one scale division. The scale is published so that a reader may if he wishes attach an intensity value to any of the earthquakes listed in Table 1 that he has experienced.

MODIFIED MERCALLI INTENSITY SCALE OF 1931

(ABRIDGED)

I. Not felt except by a very few under especially favourable circumstances. (I Rossi-Forel Scale)

II. Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing. (I to II Rossi-Forel Scale)

III. Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration like passing truck. Duration estimated. (III Rossi-Forel Scale)

IV. During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make creaking sound. Sensation like heavy truck striking building. Standing motor cars rock noticeably. (IV to V Rossi-Forel Scale)

V. Felt by nearly everyone; many awakened. Some dishes, windows, etc. broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop. (V to VI Rossi-Forel Scale)

VI. Felt by all; many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight. (VI to VII Rossi-Forel Scale)

VII. Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motor cars. (VIII Rossi-Forel Scale)

VIII. Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Disturbing to persons driving motor cars. (VIII+ to IX Rossi-Forel Scale)

IX. Damage considerable in specially designed structures; well designed frame structures thrown out of plumb: great damage in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken. (IX+ Rossi-Forel Scale)

X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks. (X Rossi-Forel Scale)

XI. Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipe lines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.

XII. Damage total. Waves seen on ground surfaces. Lines of sight and level distorted. Objects thrown upward into the air.

DISCUSSION OF EARTHQUAKES

A map is included to show that area of Canada covered in this report, and to help the reader identify the locality of the earthquakes. Some epicentres are marked on the map, particularly those listed by Gutenberg. However it should be pointed out that the number of earthquakes plotted on the map is incomplete, first, because many small tremors cannot be located, and secondly, because prior to the 1918 earthquake many of the strong earthquakes were not assigned epicentral co-ordinates. Furthermore, many of the early epicentres are not accurate.

It is not proposed that Table 1 be used for a statistical study of earthquakes in British Columbia. For example, it would be misleading to divide the number of earthquakes of a certain intensity by the number of years covered by this report, and on the basis of the result state that an earthquake of that intensity will occur every so many years.

During the early years covered by this report the province was largely uninhabited, and even today an earthquake of intensity IV or V may occur unnoticed in many parts of British Columbia. The report is probably reasonably complete for the Victoria-Vancouver area for earthquakes of intensity greater than IV. For any other part of the province the report is probably complete only for those earthquakes greater than intensity VII to VIII. Many small shocks off the coast were probably unnoticed during the period covered by this report, small local shocks having been located only since the establishment of the seismograph network in 1951. The absence of data on oceanic earthquakes constitutes another good reason for not using Table 1 for statistical study, because although they have little to do with the seismicity of the inhabited areas of British Columbia, it may be argued that if strong earthquakes occur under the ocean, the stresses on the land areas may be modified.

The following abbreviations, principally for the names of periodicals and other sources of information, have been used in Tables 1 and 2.

M magnitude (Gutenberg and Ritcher scale).

BSSA *Bulletin of the Seismological Society of America*, Vol. 29, No. 1, 1939.

YUKON

NORTHWEST TERRITORIES

BRITISH COLUMBIA

ALBERTA

WASHINGTON

PACIFIC OCEAN

ALASKA

COAST MOUNTAINS

ROCKY MOUNTAINS

QUEEN CHARLOTTE ISLANDS

VANCOUVER ISLAND

STRAIT of GEORGIA

JUAN DE FUCA STRAIT

PEACE RIVER

FRASER RIVER

N. THOMPSON RIVER

COLUMBIA RIVER

OKANAGAN LAKE

KOOTENAY LAKES

CANADA U.S.A.

Atlin
Sitka
Terrace
Prince Rupert
Masset
Skidegate
Rose Harbour
Bella Coola
Port Hardy
Estevan Pt.
Alberni
Nanaimo
Vancouver
Victoria
Chilliwack
Ft. St. John
Prince George
Quesnel
Clinton
Kamloops
Jasper
Revelstoke
Banff
Vernon
Kelowna
Nelson
Fernie
Grand Forks

151 150 184 94 93 95 168 212 122 123 125 126 127 69 75 97 234 239 232 233 79 223 83 100 132 159 163 164 210 138 130 203 54 133 228 188 74 84 99 102 240 218 219 61 62 70 71 96 165 66 140 226 135 155 189 238 161 169 146 149 237 58 116 115 136 175 78 144 215 73 50 59 236 16 104 86 63 156

25 0 25 50 75 100 125 150 Miles

JAGS *Journal of the American Geographical Society of New York*, 1873.
Diary Diary of Martha Cheney Ella (courtesy of Provincial Archives, Victoria).
Br. Col. *British Colonist*, Victoria.
Col. *Daily Colonist*, Victoria.
Br. D. C. Bradford[9].
Times *Daily Times*, Victoria.
G. B. Gutenberg and C. F. Richter, "Seismicity of the Earth".
D. Scrapbook of F. Napier Denison.
ISS International Seismological Summary.
SB Scrapbook of E. A. Hodgson.
Province *Daily Province*, Vancouver.
USC and GS United States Coast and Geodetic Survey epicentre cards.
* An asterisk indicates that there is some doubt of the location of the origin of the earthquake since the location indicated by the official co-ordinates for the epicentre does not agree with that of the felt area. Such earthquakes are not plotted on the map.

TABLE 1

EARTHQUAKES IN BRITISH COLUMBIA. DECEMBER 2, 1841 TO JULY 31, 1951

1. 1841 DECEMBER 2. 4 p.m. Duffot de Mofras, apparently an early explorer, describes a report of earthquakes felt at Fort Vancouver by a Mr. Yale: "We had two that might have attracted the attention of the geologist. Both occurred after the eruption of Mount Baker. The first was tremulous, and caused some dilapidation of tottering things; but its greatest peculiarity was perhaps the loud report that preceded or attended it, and the roaring noise, which continued for some time. The adjacent mountains, being composed of tremendous masses of solid rock, we almost expected to behold them and ourselves sinking into an abyss. The other was undulatory, and did some injury to the foundation of our house. It seemed to have come from the westward, and to have left in its trail a cold, disagreeable, smoky vapour. Both occurred in winter. That of December 26 was felt here, but I believe slightly, having escaped my perception." *JAGS*
2. 1853 NOVEMBER 25. 5 p.m. "Shook whole of house, and nearly took us off our feet." *Diary*
3. 1856 DECEMBER 26. An early explorer's letter states of this earthquake: "This last one of December 26, 1856, was very perceptible at Port Townsend, where I then was, jarring the house like the fall of some heavy body. It was felt by Mr. Warbass at Widbey's Island and the Indians told him, in reply to his inquiry if they knew what it was, that the earth was rising." *JAGS*
4. 1859 JUNE 22. 3 p.m. III to IV. Oscillation from west to east of two or three seconds duration at Victoria. *Br. Col.*

5. 1859. JUNE 22. 5:30 p.m. Rumbling at Victoria. *Br. Col.*

6. 1860 MARCH 26. 3 p.m. Felt at Old Langley. Oscillation seemed to be from east to west. Some people rushed from their homes. *Br. Col.*

7. 1860 DECEMBER 12. 8:40 p.m. Severe from Victoria to Portland.

8. 1863 SEPTEMBER 26. 1:30 p.m. A rather severe shock was felt at Vancouver.

9. 1863 OCTOBER 9. 2:53 a.m. In Victoria three shocks were felt. The first two followed each other by a few seconds, and they were followed by another in 10 minutes. Bottles fell off shelves and some people ran out of doors. *Br. Col.*

10. 1864 SEPTEMBER 26. 12:45 a.m. In Victoria the duration was estimated as 10 seconds. The shock was felt at Port Townsend also, where there was more rumbling. *Br. Col.*

11. 1864 OCTOBER 29. 6:10 p.m. VI Victoria. Felt severely in Victoria, New Westminster, Vancouver. Holden describes it as the severest shock recorded to that time. In New Westminster doors rattled, and in Vancouver at least one chimney was knocked down. At Plumber Pass large trees were felled. It would appear that the epicentre was in the Gulf Islands area, but the absence of felt reports from communities in the United States indicates that the epicentre was at the northern end of the Gulf Islands group. *BSSA*

12. 1865 JUNE 12. Holden reports several shocks at Victoria and on Vancouver Island.

13. 1865 AUGUST 25. 9 p.m. VI Victoria. Heavy shock on Vancouver Island lasting two minutes, followed later by two more shocks. *BSSA*

14. 1870 MARCH 16. 2:03 a.m. Slight shock in Victoria, like a heavy gun. *Br. Col.*

15. 1870 DECEMBER 20. 3:30 p.m. IV Victoria. This tremor lasted about 12 seconds at Victoria. Motion was from east to west. *Br. Col.*

16. 1872 DECEMBER 14. 9:40·5 p.m. This was one of the major earthquakes of the Pacific coast region of British Columbia. It has been reported as being felt quite strongly as far north as Quesnel and Soda Creek in the Cariboo and as far south as Eugene, Oregon. If Neumann's curves of intensity versus distance[13] are used, the intensity at the origin of this earthquake must have been VIII or IX on the Modified Mercalli Scale. A corresponding magnitude reading would be $7\frac{1}{2}$, although some of the reports outlined below indicate an even higher value. There were few towns in British Columbia at this time, and fewer newspapers to print accounts of the event, so data are very scarce. Any information available is presented below.

Yale: Doors were rattled, bells rang, and floors of buildings were made to wave "like the decks of a vessel in a light sea".

Chilliwack: The houses oscillated and there were waves on the ground. A report in a 1915 newspaper states that a big slice of Mount Cheam (near

[13] Frank Neumann, "Earthquake Intensity and Related Ground Motion", University of Washington Press, 1954.

Chilliwack) dropped 1000 feet during the earthquake. This was likely a landslide, but it indicates that Chilliwack was quite close to the epicentre.

Vernon: A report in 1936 from this city states that 60 years ago (probably in 1872) the Indians reported a very bad earthquake. It was strong enough to knock people from their feet, and buildings and tepees came down with the vibrations.

Clinton: The earthquake awakened many people, and staggered others off their feet, causing general excitement and alarm.

Victoria: The motion seemed to be from the east to the west. Bells were rung and crockery was knocked from the shelves. People ran out on to the streets. There are reports of the earthquake being felt very strongly at Matsqui, all along the Fraser River, and at Race Rocks. In the United States there are accounts from Olympia, from Seattle where dishes were broken, from Portland and Delles, from Wallulu and Walla Walla and all along the lower Columbia River. The felt area of this tremor seems to have covered about 500,000 square miles, part of which was at sea.

To fix an epicentre for such a tremor, using only scanty macroseismic reports and no instrumental records, is a great problem. Taking the area where waves were seen on the ground as an indication of the epicentral region, then Yale and Chilliwack seem to be very near the origin. On the map the origin has been shown as being within a circle whose radius is 30 miles, and whose centre is at 49° 10′ N.lat. and 121° 00′ W.long. No estimate can be made of the accuracy of this epicentre, and it is presented merely as an attempt to fix approximately the origin of the tremor. Certainly it was east of Vancouver, north of Seattle, and probably south of Clinton. The absence of reports from further east than Vernon indicates that the centre was west of that city, and probably west of Okanagan Lake.

Following the earthquake, many tremors were reported from various places in British Columbia and northwestern Washington, which were probably aftershocks of the main disturbance. These are listed here to make the record as complete as possible, but there is the likelihood that some listed as aftershocks may well be unrelated events.

17. 1872 DECEMBER 14. 9:46 p.m. VII in Puget Sound area. This may be the main shock, with the time incorrectly reported.

18. 1872 DECEMBER 14. 10:00 p.m.

19. 1872 DECEMBER 14. 11:00 p.m.

20. 1872 DECEMBER 15. 3:00 a.m.

21. 1872 DECEMBER 15. 5:00 a.m.

22. 1872 DECEMBER 16. 9:17 a.m. VI Victoria. Very strong at Victoria and on Vancouver Island.

23. 1872 DECEMBER 19. 5:38 a.m. IV Victoria. Two slight but distinct shocks at Victoria which shook doors and windows.

24. 1873 December 17. 11-12 p.m. Bradford lists an earthquake of intensity IV at Victoria, but the newspapers make no mention of it.

25. 1880 August 22. 1:25 p.m. South Vancouver Island and northwest Washington generally felt this shock. In Victoria the rumbling motion seemed to be from south to north. Plaster was cracked, loose bricks fell, and some persons ran into the street. At 9 a.m. on the same day a slight jolt was felt in Victoria. The main earthquake was felt in Saanich and Esquimalt. At Cowichan the boats were shaken but at Nanaimo the tremor was not felt. Port Townsend and Seattle, like Victoria, felt the earthquake and at Somenos there were two gun-like shocks although Somenos appears to be north of the main area of the disturbance. *Col.*

26. 1880 August 22. 2:10 p.m. Felt at Victoria. *Col.*

27. 1880 August 22. 2:19 p.m. Felt at Victoria. *Col.*

28. 1880 December 12. 8:40 p.m. VII in the Puget Sound basin. Felt from Victoria to Portland. *BSSA*

29. 1882 April 30. 10:45 p.m. IV-V in Victoria, where the motion seemed to be from northeast to southwest. Some crockery was thrown down, and some loose plaster fell, but the earthquake was not felt by all persons in Victoria. It was felt as far south as Portland. *Col.*

30. 1883 May 10. 6:55 p.m. A slight earthquake was felt at Victoria. *Br.*

31 1885 December 8. 10:12 p.m. V in the Puget Sound basin. Felt at both Victoria and New Westminster. *Br.*

32. 1891 September 22. 3:40 a.m. Bradford lists, and newspapers report, an earthquake at Victoria, Port Angeles, and Port Townsend at this time, of intensity VI. At Victoria some plaster was cracked, and dishes were shaken but no major damage was done. The *BSSA* reports this same earthquake for September 21st. *Col.*

33. 1891 November 29. 3:14 p.m. An earthquake which was quite strong in the lower Puget Sound basin was felt only slightly in Victoria. *Col.*

34. 1893 February 16. Residents of Sidney report a slight tremor. *Br.*

35. 1894 January 14. Bradford reports that pictures swayed and dishes rattled on their shelves at Vancouver during an earthquake. Newspapers make no mention of the event.

36. 1891 April 16. 12:00 a.m. (midnight). In Victoria the motion appeared to be from east to west, and an earthquake was generally felt. It seems to have been much stronger at Port Townsend. *Times*

37. 1895 July 2. 7:00 p.m. At Nanaimo some crockery was broken, but the tremor was not felt at Victoria. *Col.*

38. 1895 November 30. At Kyugot on the northwest shore of Vancouver Island Indian houses were shaken from their foundations, and trees swayed. *Br.*

39. 1896 JANUARY 3. 10:30 p.m. An earthquake was felt strongly at Port Angeles and Turn Point Light House. In Victoria and Esquimalt it was generally felt but no damage was reported. *Times*

40. 1896 MARCH 15. A Vancouver newspaper account for this date reads in part as follows: "One of the Burrard Mountains is believed to have been in a state of eruption last night. Dense smoke and flames poured from the mountain. Several earth shocks were felt recently." *Br.*

41. 1900 JANUARY 30. p.m. An earthquake was felt slightly in Vancouver, New Westminster, and Aldergrove. *Col.*

42. 1900 NOVEMBER 18. Afternoon. A slight earthquake was felt at Vancouver. *Col.*

43 1904 MARCH 16. 8:21 p.m. $\phi = 47°$ N; $\lambda = 124°$ W. *BSSA.* A shock was felt in the region from Seattle to Victoria, and in the Olympic Peninsula west of Puget Sound. In Victoria clocks were stopped, but no serious damage was reported. The tremor was not felt at Nanaimo. *BSSA, Col.*

44. 1906 JANUARY 3. 5:42 a.m. Felt at Nelson, where plaster was knocked down, hanging pictures were displaced, and articles fell from shelves. Rossland and Trail seem to have suffered to the same extent. At Revelstoke windows rattled, and at Grand Forks buildings trembled. *Col., BSSA*

45. 1906 MAY 14. The Vancouver *Province* reports an earthquake in the Kootenay Mountains for this date.

46. 1907 JULY 28. 2:20 a.m. In Victoria many people were awakened. The Port Townsend area seems to have been disturbed an equal amount. *Col.*

47. 1908 MAY 15. 12:31·6 a.m. $\phi = 59°$ N; $\lambda = 141°$ W; M = 7·0. *G.*

48. 1908 NOVEMBER 30. Afternoon. At Skidegate, on the Queen Charlotte Islands, two Indian shacks were knocked to the ground. The wave seemed to pass from north to south. Furniture vibrated at Lawnhill, a few miles north of Skidegate. This earthquake was strong enough to have recorded on the seismographs at Ottawa. *Queen Charlotte News*

49. 1908 DECEMBER 1. 3 a.m. An aftershock of the above event was felt at Lawnhill.

50. 1909 JANUARY 11. 3:44 p.m. A tremor, whose origin seems to have been in the Gulf Islands between Victoria and Bellingham, was felt over an area greater than 25,000 square miles. The intensity near the origin was of the order of VI.

At Victoria, where the vibration lasted from 10 to 20 seconds, the most serious damage reported was that of broken crockery. At Blaine walls were cracked; Bellingham reported sidewalks twisted; and at Anacortes the piers were damaged. Ladysmith, Nanaimo, and Alberni felt the tremor quite distinctly. Reports indicate that the earthquake was felt at Comox, Pachena Point, Bamfield, Sumas, Chilliwack, Hammond, Everett, Lopez, Port Townsend, Tacoma, and south to Portland, but was not felt as far east as Kelowna, Princeton or Vernon. It appears that placing the epicentre in the Gulf

Islands area is as good an approximation as is possible, for no instrumental recording of the origin is available. *Col., BSSA*

51. 1909 May 17. 9:20 a.m. Vancouver newspapers report a strong vibration was felt over all the western provinces at this time. Information comes from Winnipeg, Regina, and strangely enough from Prince Rupert. No major tremor was recorded at this time which could have been felt over such a wide area. It is suggested that little weight be placed upon these reports.

52. 1911 July 4 or 5. 10:23 p.m. Victorians felt a slight earthquake. *Br.*

53. 1911 September 28. 6:45 p.m. A tremor frightened many people at Bellingham. In Victoria the motion seemed to be from northwest to southeast. Nothing was felt at Seattle, hence it appears that the epicentre was in the Gulf Islands area. *Col.*

54. 1912 March 11. 2:17·5 a.m. $\phi = 51°$ N; $\lambda = 131°$ W; M = 6½. *G.* The Victoria seismograph indicated the distance to the origin of this earthquake as 300 to 400 miles. The disturbance was felt at Triangle Island off the northwest tip of Vancouver Island. *Col.*

55. 1912 August 18. Newspaper reports indicate an earthquake was felt at Salmon Arm near Clowhan Lake, also at Sechelt, Deserted Bay, and up to the head of Jervis Inlet. *D*

56. 1912 November 21. Newspapers reported an earthquake in the Lynn Valley and Blenkinsop Bay in south central British Columbia. *D*

The Vancouver *Times* reported an earthquake was felt from the Fraser River to the end of Burrard Inlet on the same day at 4:47 p.m. The Victoria seismograph recorded an earthquake occurring at this time at a distance of 100 to 200 miles. Another tremor was recorded at 5:15 p.m. but it was not felt.

57. 1913 October 18. The south end of Graham Island in the Queen Charlotte Islands was shaken. *D*

58. 1914 July 21. 2:31·3 p.m. $\phi = 49°$ N; $\lambda = 130°$ W; M = 6½. *G.* Not felt.

59. 1915 August 18. 6:05 a.m. $\phi = 48°\ 32'$ N; $\lambda = 121°\ 26'$ W. *Br.* An earthquake was felt from Seattle to Enderby, and from Victoria to the Okanagan Valley. At Victoria the S-P time on the seismograph was 17 seconds, indicating a distance of 91 miles. The tremor was felt at Penticton, Yale, Summerland, Harrison, Bellingham (where doors rattled), Kelowna, Chilliwack (where it was quite violent), and Enderby. At Marblemount an aftershock was felt at 10:00 a.m. *Col., BSSA*

60. 1916 June 19. 5:50 a.m. III. Nanaimo residents generally felt a tremor. *Col.*

61. 1917 July 1. $\phi = 50°.0$ N; $\lambda = 128°.0$ W. *BSSA*

62. 1917 December 23. $\phi = 50°.0$ N; $\lambda = 128°.0$ W. *BSSA*

63. 1918 February 4. 12:35. $\phi = 51°.0$ N; $\lambda = 118°.0$ W. *ISS.* An earthquake was generally felt at Revelstoke, and felt slightly at Alvert Canyon, Beaver-

mouth, Malakwa and Vernon. The seismograph at Victoria recorded the tremor. *D., SB*

64. 1918 FEBRUARY 13. 5 a.m. Very slight at Victoria. *Col.*

65. 1918 AUGUST 22. 8:21 a.m. Felt slightly in Victoria and at Cordova Bay. *Col.*

66. 1918 DECEMBER 6. 00:41 a.m. $\phi = 49\frac{3}{4}°$ N; $\lambda = 126\frac{1}{2}°$ W; M = 7. *G.* Estevan lighthouse on the west shore of Vancouver Island was the place closest to the epicentre of this earthquake, and considerable mercury was spilled out of the lighthouse lamp due to the tremor. One report stated that the lighthouse itself swayed. At Alberni, 117 miles from the official epicentre, the intensity was rated as IV or V. At both Nanaimo and Ladysmith the earthquake was compared to an explosion. Buildings rocked, and people were violently awakened. The earthquake was felt at Victoria, Vancouver, Kelowna and Seattle, but not at Vernon, Penticton, Chilliwack or Armstrong in the interior. A detailed report was written by F. Napier Denison.[11] *Col.*

67. 1918 DECEMBER 7. About ten aftershocks of the December 6 tremor were felt at Alberni and Estevan.

68. 1918 DECEMBER 16. 5:09 a.m. A strong aftershock of the December 6 tremor was felt at Alberni.

69. 1919 MAY 18. $\phi = 56°.0$ N; $\lambda = 136°.0$ W. *ISS.*

70. 1919 JULY 1. $\phi = 50°.0$ N; $\lambda = 128°.0$ W. *ISS.*

71. 1919 JULY 10. $\phi = 50°.0$ N; $\lambda = 128°.0$ W. *ISS.*

72. 1919 OCTOBER 10. $\phi = 49°.0$ N; $\lambda = 124°.0$ W. *ISS*.* This may be in error for no tremor was felt.

73. 1920 JANUARY 23. 11:10 p.m. $\phi = 49°$ N; $\lambda = 122°\ 40'$ W. *Br.* The epicentre was again near the Gulf Islands, although the position cannot be very precise since there were few seismographs near the origin. At Victoria there was a severe shaking. Windows were broken at Anacortes, and plaster was cracked at Bellingham. One report states that boulders were shaken off Crown Mountain near Vancouver, and some windows were broken in the city itself. At New Westminster people were alarmed and ran into the streets. Some chimneys were cracked and furniture was moved in houses. (See *BSSA*, Vol. 10, pp. 46-48) *Col., BSSA.*

74. 1920 MARCH 28. 9:08 p.m. $\phi = 51°$ N; $\lambda = 129°$ W; M = $6\frac{1}{2}$. *G.*

75. 1920 MAY 8. $\phi = 56°.0$ N; $\lambda = 136°.0$ W. *ISS.*

76. 1920 JULY 20. 8:07 p.m. Felt in Victoria. *Br.*

77. 1920 NOVEMBER 28. 3:30 a.m. $\phi = 50°.0$ N; $\lambda = 128°.0$ W. *ISS.* This epicentre may be in error for the tremor was felt in southern Washington, and in northern Oregon.

78. 1921 FEBRUARY 21 $\phi = 52°.0$ N; $\lambda = 125°.0$ W. *ISS.** The newspapers make no mention of this earthquake.

79. 1921 April 10. 5:40 a.m. $\phi = 54°$ N; $\lambda = 134°$ W; M = $6\frac{1}{2}$. *G.* An earthquake was felt at Masset on the Queen Charlotte Islands. No damage was reported, although pictures on the wall were made to swing.

80. 1921 April 10. 11 a.m Aftershock of preceding tremor at Masset.

81. 1921 April 11. 7 am. Aftershock at Masset.

82. 1921 April 11. 7:30 a.m Aftershock at Masset.

83. 1921 April 12. $\phi = 53°.2$ N; $\lambda = 133°.7$ W. *ISS.*

84. 1921 May 28. 12:55 p.m. $\phi = 48°.0$; $\lambda = 127°.5$. *ISS.** The localities of Alert Bay and Bull Harbour on northern Vancouver Island felt the tremor. Estevan did not. The seismograph record at Victoria indicated a distance of 200 miles. The felt area and the official epicentre are about 250 miles apart, and on the map the former position is indicated.

85. 1921 June 25. $\phi = 49°.0$ N; $\lambda = 124°.0$ W. *ISS.** Not reported from any area.

86. 1922 April 13 $\phi = 60°.0$ N; $\lambda = 110°.0$ W. *ISS.* This epicentre is east of any active area in western Canada.

87. 1922 May 15. 9:30 a.m. Felt in Vancouver. *Col.*

88. 1922 December 27. 6:30 p.m. Denison suggested that the epicentre was under Haro Strait. The tremor was felt in Victoria and Vancouver but no damage was reported *Col.*

89. 1923 January 10. 8:27 p.m. Felt slightly at Victoria. *D*

90. 1923 February 12. 10:20 a.m. The Bellingham area, where plaster was cracked, seems to have been the hardest hit. At Victoria the earthquake was felt but slightly. *Col., BSSA*

91. 1923 March 12. Felt slightly in the Gulf Islands region, but not at Victoria. *BSSA*

92. 1923 April 13. 2-26 a.m. Gonzales seismograph indicated a distance of 110 miles, but this does not necessarily place the origin in British Columbia. *D*

93. 1923 April 24. $\phi = 59°.0$ N; $\lambda = 135°.5$ W. *ISS.*

94. 1923 April 25. 11:32 a.m. $\phi = 59°$ N; $\lambda = 138°$ W; M = $5\frac{3}{4}$. *G.*

95. 1923 April 29. $\phi = 59°.0$ N; $\lambda = 135°.5$ W. *ISS.*

96. 1923 May 2. 8:24 a.m. $\phi = 50°.0$ N; $\lambda = 128°.0$ W. *ISS.* At Victoria the seismograph indicated a distance of 170 miles.

97. 1923 June 22. $\phi = 56°.0$ N; $\lambda = 136°.0$ W. *ISS.*

98. 1923 July 13-14. 9:30 a.m. At Dead Tree Point on the Queen Charlotte Islands an earthquake was felt.

99. 1923 October 13. $\phi = 50°.5$ N; $\lambda = 129°.5$ W. *ISS.*

100. 1923 November 16. $\phi = 53°.0$ N; $\lambda = 131°.0$ W. *ISS.*

101. 1923 November 22. 7:04 p.m. Victoria and Saanich areas, generally, felt a rumbling earthquake. *Col.*

102. 1924 MARCH 29. 4:09 p.m. $\phi = 50°$ N; $\lambda = 130\frac{1}{4}°$ W; M = 6. *G.*

103. 1924 AUGUST 8. 3: a.m. III. A report from Chilliwack stated that an area about 6 miles square in the Sumas district felt a slight tremor. A Victoria newspaper report mentioned persons being awakened by the tremor in that city and in Bellingham. The epicentre was probably in the Sumas district. *D*

104. 1924 OCTOBER 17. $\phi = 60°.0$ N; $\lambda = 118°.0$ W. *ISS.*

105. 1924 NOVEMBER 4. 3:19 a.m. An earthquake was felt slightly in Victoria. *Col.*

106. 1924 DECEMBER 18. 3:10 a.m. III. Vancouver was the only area to feel the tremor strongly, although it was noticeable in Duncan and Victoria. *D*

107. 1925 FEBRUARY 10. 2:32 a.m. A tremor was felt slightly in Victoria. *D*

108. 1925 JUNE 28. 5:20 p.m. This has been identified as the Montana earthquake, but it is included here for a tremor was felt in some parts of British Columbia, particularly at Nelson.

109. 1925 AUGUST 1. 12:50 p.m. The Victoria area felt a tremor slightly, but the epicentre appears to be south, in the Olympic mountain range. *D*

110. 1925 AUGUST 10. 8:20 p.m. Newspaper reports indicated an earthquake was felt at Lethbridge, Coutts, Taber, and Milk River in southern Alberta.

111. 1925 NOVEMBER 26. 1:40 a.m. III. The distance from the Victoria seismograph station to the origin of this earthquake was estimated as 6 miles, although it is likely the epicentre was under Haro Strait. Bellingham and Victoria both report a rumbling noise accompanying the tremor. No tremor was felt at Vancouver or New Westminster. *Col.*

112. 1926 MARCH 10. $\phi = 66°.5$ N; $\lambda = 130°.0$ W. *ISS.* Yukon area.

113. 1926 SEPTEMBER 17. $\phi = 49°.0$ N; $\lambda = 124°$ W. *ISS.** There are no reports to indicate that the tremor was felt, although the epicentre fell in a populated area.

114. 1926 SEPTEMBER 22. $\phi = 49°.0$ N; $\lambda = 124°.0$ W. *ISS.**

115. 1926 OCTOBER 30. 11:41 a.m. $\phi = 48\frac{1}{2}°$ N; $\lambda = 129°$ W; M = 6. *G.*

116. 1926 OCTOBER 31. 11:29 p.m. $\phi = 48\frac{3}{4}°$ N; $\lambda = 128\frac{1}{2}°$ W; M = $6\frac{1}{2}$. *G.*

117. 1926 DECEMBER 4. 3 a.m. The Shawnigan Lake district felt a slight tremor, identified by Denison as a foreshock of the following earthquake.

118. 1926 DECEMBER 4. 6 a.m. IV. An earthquake was generally felt throughout the Victoria area, northwest to Alberni, northeast to New Westminster and south to Port Townsend. There were no reports of serious damage, although some goods were toppled from shelves at Bellingham, and at Friday Harbour on San Juan Island the tremor was felt as a severe explosion. The epicentre was probably in the Gulf Islands area, although if the 3 a.m. jolt was a foreshock the epicentre could have been on southern Vancouver Island. *Col., BSSA, SB*

119. 1927 MARCH 6. 1:57 p.m. An earthquake was felt at Bull Harbour, Alert Bay and Ocean Falls off the north tip of Vancouver Island. *D*

120. 1927 May 8. 2 p.m. $\phi = 49°.0$ N; $\lambda = 124°.0$ W. *ISS.** Again Bull Harbour, Alert Bay, and Ocean Falls as well as Port Hardy felt a tremor. The *ISS* epicentre is some 2° south of the felt area, in a populated region where the tremor was not felt. *D*

121. 1927 May 27. 1:58 p.m. Estevan, Bull Harbour, Alert Bay and Ocean Falls all felt an earthquake. The epicentre is probably just off the northwest tip of Vancouver Island.

122. 1927 October 24. 7:59 p.m. $\phi = 57\frac{1}{2}°$ N; $\lambda = 137°$ W; M = 7. *G.*

123. 1927 October 25. $\phi = 56°.4$ N; $\lambda = 136°.0$ W. *ISS.*

124. 1927 October 29. An earthquake was felt generally in Vancouver and in the communities directly east of there. It was not felt at Victoria, nor was it recorded on the seismographs.

125. 1927 November 12. $\phi = 56°.4$ N; $\lambda = 136°.0$ W. *ISS.*

126. 1927 November 21. $\phi = 56°.4$ N; $\lambda = 136°.0$ W. *ISS.*

127. 1927 December 31. $\phi = 56°.4$ N; $\lambda = 136°.0$ W. *ISS.*

128. 1928 January 24. 9:45 a.m. III. The Abbotsford-Hunglington area felt an earthquake. Maple Falls, Glacier, Sumas and Deming in the general region also felt the tremor slightly, but Bellingham did not. *D*

129. 1928 February 9. 3:04 a.m. IV. The Victoria seismograph indicates an epicentre about 100 miles northwest of the city. Alberni, Bamfield, and Pachena Point felt the tremor most severely. At Alberni it was like a loud report, and near Bamfield small tidal waves were reported. Vancouver and Nanaimo reported the tremor as very slight. It was also felt at Abbotsford, Duncan, Cowichan, Victoria, Port Renfrew, Tatoosh and Destruction Islands. The epicentre was probably in the region of the Alberni canal. *D, Prov.*

130. 1929 March 1. 11:31 p.m. $\phi = 51\frac{1}{2}°$ N; $\lambda = 130\frac{3}{4}°$ W; M = 6. *G.*

131. 1929 April 22. Felt very slightly at Victoria. *Times*

132. 1929 May 26. 2:42 p.m. VI-VII. $\phi = 51°$ N; $\lambda = 131°$ W; M = 7. *G.* The epicentre of this tremor was between 1° and 2° south of the area of maximum damage, in a region that was not heavily populated. The earthquake was felt as far north as Ketchikan, Alaska, and Anyox, B.C. and to the east as far as Terrace, Skeena and Lakelse. Prince Rupert does not appear to have been in the area of maximum damage, but at Haysport, a short distance southeast of Prince Rupert, goods were knocked off shelves. Centres on the Queen Charlotte Islands suffered greatly. At Massett, water was splashed out of tanks, trees were reported to have swayed, and houses shook violently. The Prince Rupert paper stated that people were thrown to the ground. At Queen Charlotte City dishes were broken, clocks were stopped, and a 4-foot tidal wave was reported. Nearby at Skidgate there was a tidal wave, and there were fissures on the beach. At Sandspit 500 feet of the beach was reported to have disappeared into the sea. Further south at Lockeport the crest of a hill was dislodged, and close by at Rose Harbour chimneys were

toppled. From these reports it would appear that the major damage was along the east shore of the Queen Charlotte Islands, but this is probably because that was the only settled portion of the region. Certainly the epicentre must have been quite close to Queen Charlotte city and Skidegate, probably just west of Graham Island. Such origin is indicated on the map.

133. 1929 SEPTEMBER 17. 11:17 a.m. $\phi = 51°$ N; $\lambda = 131°$ W; M = $6\frac{1}{4}$. *G.*

134. 1929 DECEMBER 14. Severe on Graham Islands. *D*

135. 1930 APRIL 16. 6:30 a.m. $\phi = 49\frac{1}{2}°$ N; $\lambda = 130°$ W; M = $5\frac{1}{2}$. *G.*

136. 1930 MAY 31. 2:21 a.m. $\phi = 48\frac{1}{3}°$ N; $\lambda = 129°$ W; M = $5\frac{1}{2}$. *G.*

137. 1930 JUNE 26-JUNE 30. On the Queen Charlotte Islands. *D*

138. 1930 JULY 1. $\phi = 51°.5$ N; $\lambda = 133°.3$ W. *ISS.*

139. 1930 JULY 21. 3:59 a.m. Two slight tremors were felt in Victoria. Denison placed the epicentre in the Strait of Juan de Fuca. The tremor was also felt in Vancouver. *D.*

140. 1930 SEPTEMBER 17. $\phi = 49°.5$ N; $\lambda = 130°.5$ W. *ISS.*

141. 1931 APRIL 17. 8 p.m. III. A slight earthquake was felt in Vancouver, Abbotsford, Bellingham and Victoria. The Gulf Islands area was again the probable origin of this disturbance. *D., Prov.*

142. 1931 JULY 18. III. Felt slightly in Victoria and Vancouver. *Br.*

143. 1931 JULY 30. 8 a.m. IV. At Nanaimo the earthquake sounded like an explosion. Houses in Kitsilano, a section of Vancouver, were rocked. Victorians did not report feeling the tremor. *Prov.*

144. 1932 JANUARY 26. 2:12 a.m. $\phi = 52°.0$ N; $\lambda = 125°.0$ W. *ISS.* No earthquake was reported to have been felt.

145. 1932 JULY 18. 2:02 p.m. The Tolt River earthquake, with epicentre about 25 miles northeast of Seattle, was felt in Vancouver and Victoria.

146. 1932 AUGUST 18. 12:23 p.m. $\phi = 49°$ N; $\lambda = 129°$ W. *G.*

147. 1932 DECEMBER 21. 10:10 p.m. Felt slightly in Vancouver. *Prov.*

148. 1933 JANUARY 29. 1:42 a.m. Felt in Sidney and North Saanich. *Col.*

149. 1933 MAY 4. 8:14 p.m. $\phi = 49°$ N; $\lambda = 129°$ W; M = $5\frac{1}{2}$. *G.*

150. 1933 AUGUST 30. 6:51 p.m. $\phi = 59\frac{1}{4}°$ N; $\lambda = 137\frac{1}{2}°$ W; M = $5\frac{1}{4}$. *G.*

151. 1933 SEPTEMBER 19. 3:39 p.m. $\phi = 60°$ N; $\lambda = 138°$ W. *G.*

152. 1933 OCTOBER 5. 6:38 p.m. IV. Nanaimo residents felt this shock as an explosion, as did the area about Chemainus. The tremor was felt slightly at Comox, Victoria and Vancouver, and heavily at Parksville and Wellington. The origin is probably on Vancouver Island near Nanaimo or immediately off shore under the Strait of Georgia. *Prov., D., SB*

153. 1934 APRIL 12. 9:30 p.m. III. A tremor was felt at Port Alberni, Long Beach, Tofino, Ucluelet on the west coast of Vancouver Island. Tofino appears to have been the location of maximum intensity. No tremor was felt at Nanaimo.

154. 1934 MAY 4. 8:09 p.m. IV. The general areas of Victoria, Port Townsend, Port Angeles, Everett, Duncan and Vancouver felt the earthquake equally. Nanaimo felt it slightly less. At Vancouver some plumbing was reported damaged.

155. 1935 September 24. 2:12 p.m. $\phi = 49\frac{1}{2}°$ N; $\lambda = 130°$ W; M = $6\frac{1}{4}$. *G.*

156. 1936 MARCH 28. 1:15 a.m. V. From newspaper files and clippings an isoseismal map can be readily drawn for this earthquake. Such a map indicates an epicentre at 50°5 N. and 119°5 W. In Vernon dishes were broken, plaster was cracked and the earthquake was described as a dull roar lasting 5 to 10 seconds. Residents of Oyama, slightly south, heard rockslides in the mountains, and a short distance south of Sicamous, at Mara, bricks were dislodged from chimneys. At Grindrod, near Sicamous, some aftershocks were felt. Notch Hill residents reported four chimneys down. At Kamloops the main shock rattled dishes, and an aftershock at 4 a.m. was felt. At Salmon Arm, Penticton, Merritt, Lumby, Kelowna and Lavington residents generally were awakened.

157. 1936 APRIL 22. 9:53 p.m. Felt slightly in Victoria. *SB*

158. 1936 JULY 15. 11:20 p.m. Residents of Rock Creek, on the Kettle River Valley, were alarmed by an earthquake.

159. 1936 DECEMBER 21. 11:03 a.m. $\phi = 52\frac{1}{2}°$ N; $\lambda = 131\frac{1}{2}°$ W; M = 6. *G.* A tremor was felt at Dead Tree Point on the Queen Charlotte Islands.

160. 1937 On an unrecorded date an earthquake shook the north shore at Vancouver at 6 a.m. *D*

161. 1937 SEPTEMBER 29. 3:30 a.m. $\phi = 49\frac{1}{4}°$ N; $\lambda = 129\frac{1}{2}°$ W; M = $5\frac{1}{2}$. *G.*

162. 1938 FEBRUARY 19. 6:13 a.m. Felt in Vancouver, and particularly on the north shore. *Prov.*

163. 1938 MARCH 22. 7:22 a.m. $\phi = 52\frac{1}{4}°$ N; $\lambda = 132°$ W; M = $6\frac{1}{4}$. *G.* The earthquake was felt strongly on the Queen Charlotte Islands and up to the Alaskan panhandle. Dishes rattled in Prince Rupert. *Prince Rupert Daily News.*

164. 1938 MARCH 22. 2:27 p.m. $\phi = 52\frac{1}{4}°$ N; $\lambda = 132°$ W; M = $5\frac{1}{4}$. *G.*

165. 1938 APRIL 21. 8:15 p.m. $\phi = 49\frac{3}{4}°$ N; $\lambda = 129\frac{3}{4}°$ W; M = $5\frac{1}{2}$. *G.*

166. 1938 JUNE 27. An earthquake was felt in Victoria. *D.* Newspapers reported that the seismograph was out of operation while it was being transferred to the Dominion Astrophysical Observatory and that there were a few tremors about this time.

167. 1938 SEPTEMBER 19. 4:40 a.m. Slightly felt in Vancouver. *Prov.*

168. 1938 OCTOBER 14. 7:52 a.m. $\phi = 58\frac{1}{2}°$ N; $\lambda = 136°$ W; M = 5. *G.*

169. 1939 JULY 18. 7:26 p.m. $\phi = 49°$ N; $\lambda = 129\frac{1}{4}°$ W; M = $6\frac{1}{2}$. *G.*

170 1939 NOVEMBER 6. 6:30-7:30 p.m. A letter on file from a resident of Kennedy Lake reported an earthquake in that region of west central Vancouver Island.

171. 1939 NOVEMBER 24. 4:45 p.m. An earthquake was reported at Nanaimo as a dull thud.

172. 1940 JANUARY 28. 12:28 a.m. $\phi = 61\frac{3}{4}°$ N; $\lambda = 137\frac{1}{2}°$ W; M = $5\frac{1}{4}$. *G.*

173. 1940 MAY 28. 5:57 p.m. $\phi = 67°$ N; $\lambda = 135°$ W; M = $6\frac{1}{4}$. *G.* Yukon.

174. 1940 JUNE 5. 3:01 a.m. $\phi = 67\frac{1}{2}°$ N; $\lambda = 136°$ W; M = $6\frac{1}{2}$. *G.* Yukon.

175. 1940 SEPTEMBER 8. 10:20 a.m. This is the first of a series of fairly strong local shocks in the Bella Coola area of British Columbia. Residents were generally alarmed, but no serious damage was mentioned in the reports of the British Columbia Provincial Police. The following list of the tremors is in the order of their occurrence, and unless noted, all are of the same intensity.

176. 1940 SEPTEMBER 8. 10:30 a.m.; 9:20 p.m. Bella Coola.

177. 1940 SEPTEMBER 9. 5:20 a.m. Bella Coola.

178. 1940 SEPTEMBER 10. 3 a.m.; 3:10 a.m.; 8 a.m.; 8 p.m. Bella Coola.

179. 1940 SEPTEMBER 11. 8:05 a.m.; 8:15 a.m. Bella Coola.

180. 1940 SEPTEMBER 12, 13, 26, 27. Bella Coola.

181. 1940 OCTOBER 8, 9, 11, 12, 13, 23, 24. Bella Coola.

182. 1940 OCTOBER 27. 3:29 p.m. An earthquake was felt in many districts of Victoria, and in Seattle, but not in Chilliwack. A newspaper credited the earthquake with causing a landslide on highway No. 2 about 2 miles west of Hope. This appears to be unlikely. *Prov.*

183. 1940 NOVEMBER 1, 2, 3, 4, 5, 6, 23, 25. All were felt at Bella Coola.

184. 1941 AUGUST 9. 9:05 p.m. $\phi = 59\frac{1}{4}°$ N; $\lambda = 137\frac{1}{2}°$ W; M = $5\frac{1}{4}$. *G.*

185. 1941 OCTOBER 31. 4:43 p.m. An earthquake was recorded on the Victoria seismograph at a distance of 350 miles in an unknown direction.

186. 1942 JANUARY 18. 2:45 a.m. Dr. Whiting reports from Bella Coola that a stronger than normal tremor was felt.

187. 1942 JANUARY 30. 10:49 p.m. V. $\phi = 51°$ N; $\lambda = 124°$ W; M = $5\frac{1}{2}$. *G.* The epicentres obtained from seismograms and from the felt area of this earthquake agree quite well. Powell River felt the tremor most severely, and here the newsprint machines were thrown out of line. People were generally alarmed, and reports are that a foreshock was felt a few days preceding the main tremor. At Goldbridge the main shock and two aftershocks were felt. At Manson's Landing and Cortes in the northern part of the Strait of Georgia the motion appeared to be from east to west. The earthquake tilted pictures on walls at Kamloops, and was felt stronger than this at Spences Bridge. In Vancouver dishes rattled. The epicentre indicated by Gutenberg, immediately east of Powell River, appears to be a logical choice from macroseismic evidence and newspaper reports.

188. 1942 MARCH 19. 3:59 a.m. $\phi = 50\frac{1}{2}°$ N; $\lambda = 131°$ W; M = 6. *G.*

189. 1942 JUNE 9. 3:06 a.m. $\phi = 49\frac{1}{2}°$ N; $\lambda = 129°$ W; M = $5\frac{3}{4}$. *G.*

190. 1942 JUNE 11. 6:01 p.m. $\phi = 61°$ N; $\lambda = 138°$ W; M = $5\frac{3}{4}$. *G.*

191. 1942 OCTOBER 21, 22, 29, 31. These are further reports of earthquakes felt at Bella Coola.

192. 1942 November 1. 11:55 a.m. Residents of Creston were alarmed at this particular tremor. It was felt in Canada at Nelson and Kingsgate and as far south as Coeur d'Alene and Spokane in the United States. There were three tremors in all (8:42 a.m., 11:55 a.m. and 12:16 p.m.), that at 11:55 a.m. being most generally felt.

193. 1943 April 14. 6:15 p.m. An earthquake, again strong at Bella Coola, was felt along the valley from Ocean Falls to Canoe Crossing. The motion appears to have been from west to east.

194. 1943 May 24. 10:35 p.m. Felt at Bella Coola.

195. 1943 May 26. 11:09 a.m. Felt at Bella Coola, Ocean Falls and Stuie.

196. 1943 July 31. 10:15 p.m. Felt at Bella Coola, Ocean Falls and Stuie.

197. 1943 July 31. 10:30 p.m. 11:30 p.m. Felt at Bella Coola.

198. 1943 August 1. 4:20 a.m. Felt at Bella Coola. Although this is the last available report on earthquakes felt at Bella Coola, it should not be assumed that the tremors ceased abruptly. It is probable that the absence of reported earthquakes after 1943 indicates a lack of information rather than a lack of earthquakes. There was probably a series of earthquakes for at least three years, none of which caused damage, with epicentres at one location near Bella Coola. No field investigation was made, other than a search of police reports.

199. 1943 November 29. 4:30 a.m. A slight earthquake was felt at Vancouver, and at Seattle. The Victoria records indicated the epicentre as being 200 miles north-east of Victoria. *Prov.*

200. 1944 February 3. 4:15 a.m. $\phi = 60\frac{1}{2}°$ N; $\lambda = 137\frac{1}{2}°$ W; M = $6\frac{1}{2}$. *G.* The Whitehorse (Yukon Territory) Meteorological Office reported that clocks were stopped and doors were seen to swing with the vibration. The duration was quoted as three minutes. At Aishihik and Teslin the tremor was also felt.

201. 1944 August 8. 1:00 a.m. Sister's Island lighthouse was damaged by this earthquake, apparently centered off the northern tip of Vancouver Island.

202. 1944 August 8. 4:50 a.m. An aftershock of the above earthquake was felt.

203. 1944 August 9. 5:53 p.m. $\phi = 51°.4$ N; $\lambda = 130°.5$ W. *USC and GS.*

204. 1944 September 7. 11:20 p.m. Felt at Bella Coola.

205. 1945 May 14. Residents of Prince George reported feeling four light tremors in two days about this time. *SB*

206. 1945 May 22. 1:12 a.m. An earthquake was felt slightly in Victoria.

207. 1945 June 15. 3:24 p.m. III. A tremor was felt slightly in Victoria and Vancouver. At Nanaimo goods were toppled from shelves. *Col.*

208. 1945 August 2. 12:45 p.m. $\phi = 54°$ N; $\lambda = 133°$ W; M = $6\frac{1}{4}$. *G.*

209. 1945 October 15. 00:01 a.m. $\phi = 59°.0$ N; $\lambda = 140°.0$ W. *USC and GS.*

210. 1945 October 29. 2:54 a.m. $\phi = 52°$ N; $\lambda = 131°$ W. *USC and GS.*

211. 1945 NOVEMBER 12. 9:05 p.m. An earthquake was felt slightly in Victoria. *Times.*

212. 1945 NOVEMBER 16. 10:02 a.m. $\phi = 58°$ N; $\lambda = 136\frac{1}{2}°$ W. *G.*

213. 1946 FEBRUARY 15. 7:16 p.m. An earthquake, probably centred in the southern Puget Sound area, was generally felt in Victoria. *Col.*

214. 1946 MARCH. A resident of Hornby Island in the northern Strait of Georgia reported that he felt tremors covering the period of a week.

215. 1946 JUNE 23. 9:13 a.m. $\phi = 49°\ 52'$ N; $\lambda = 124°\ 55'$ W; M = 7·3. *Milne.* This is generally referred to as the British Columbia earthquake, mentioned earlier in this report as having been discussed in detail by E. A. Hodgson.[10] Since his publication no further details of damage have become available.

216. 1946 JULY 8. 8 p.m. Felt at Courtenay near the epicentre of the previous earthquake.

217. 1946 JULY 9. A letter on file from a resident of the Great Central Lake region reports a tremor in that area. This and the July 8 event are the only reported or recorded aftershocks of the main tremor of June 23.

218. 1946 JULY 17. 10:07 p.m. $\phi = 50°$ N; $\lambda = 129°$ W; M = $6\frac{1}{2}$. *USC and GS.*

219. 1946 JULY 17. 11:16 p.m. $\phi = 50°$ N; $\lambda = 129°$ W; M = $6\frac{1}{2}$. *USC and GS.*

220. 1947 APRIL 5. 5:51 p.m. III. The *Prince George Citizen* reported that an earthquake was felt in that area, similar to the noise of a passing truck.

221. 1947 MAY 8. 3:53 p.m. $\phi = 61°$ N; $\lambda = 139°$ W. *USC and GS.*

222. 1947 AUGUST 11. 3:55 a.m. A letter on file indicates that an earthquake was felt both at Milne's Landing and near Mill Bay on South Vancouver Island.

223. 1948 FEBRUARY 27. 5:58 p.m. $\phi = 53\frac{1}{2}°$ N; $\lambda = 133°$ W; M = $6\frac{1}{2}$. *USC and GS.* An earthquake was felt at Prince Rupert and on the Queen Charlotte Islands *Col.*

224. 1948 JUNE 9. 11:05 a.m. An earthquake was felt on Read Island in the northern Strait of Georgia.

225. 1948 JUNE 24. On this date the short-period Benioff seismograph was installed at Victoria. Many earthquakes were recorded during the next three years, and the following are those that were felt or were located by means of seismograph recordings. Table 2 lists the remainder that were recorded by the seismograph but not felt nor located.

226. 1948 JULY 22. 12:05 p.m. $\phi = 49\frac{1}{2}°$ N; $\lambda = 130\frac{1}{2}°$ W. *USC and GS.* Recorded at Victoria at 12:06:55.

227. 1948 OCTOBER 1. 1:44 a.m. Felt slightly at Kamloops, B.C. and recorded at Victoria at 1:45:34.

228. 1948 DECEMBER 30. 3:49 p.m. $\phi = 51°$ N; $\lambda = 131°$ W. *USC and GS.* Recorded at Victoria at 3:51:14.

229. 1949 FEBRUARY 4. An earthquake was felt at Summerland and Peachland in south central British Columbia. *Col.*

230. 1949 April 2. 1:17 a.m. An earthquake with a rumbling noise was felt at Queen Charlotte City.

231. 1949 April 13. 11:55 a.m. $\phi = 47°.1$ N; $\lambda = 122°.7$ W; M = $6\frac{3}{4}$. *USC and GS.* This Seattle earthquake, which did extensive damage in the lower Puget Sound basin, has been included because it was felt sharply at Victoria and at Vancouver.

232. 1949 August 20. 8:03 p.m. $\varphi = 54°.2$ N; $\lambda = 133°.5$ W; M = 8·0. This tremor, known as the Queen Charlotte Islands earthquake, did some damage in populated areas near its origin, although for the most part the immediate epicentral area was very sparsely settled. Little field data are available for the earthquake, and in particular information from the main epicentral area on the Queen Charlotte Islands did not indicate that an earthquake of magnitude 8·0 had occurred. However many different seismological stations reported very strong recordings.

There is a report of a geologist working on the north-west tip of Graham Island who was unable to stand up due to the violent shaking of the ground. Two boat captains mentioned that the water near the beach at Lockport was swirling wildly, and that there were many landslides. At Delkatla the bridge "writhed like a snake", and the ground was cracked. At a lodge nearby, the horses could not be controlled even an hour before the event. The *Prince Rupert Daily News* states that just across Delkatla Slough the earth fissured, one crack 50 feet long and 6 inches across being so deep its bottom could not be seen. Many trees were felled, and in one house a piano was shifted. As far away as Prince George the people were alarmed and ran into the streets. At Cumshewa Inlet logging camp a tank containing many gallons of fuel oil was destroyed, at considerable loss to the owner. At Terrace cars rolled on the street and dishes were broken. The earthquake was felt as far east as Jasper and as far south as Portland. Using the distance to Jasper as the radius of a circle, the felt area of the tremor is of the order of 2,220,000 square miles, half of which is under the ocean. An interesting sidelight on the phenomenon of this earthquake is that at the Dominion Observatory in Ottawa observers using the meridian-circle telescope were unable to keep the cross-hair of the guiding eye-piece on the star image during the time the strong waves from this earthquake were passing Ottawa. In the Arctic area one of the Geodetic Survey party reported that while he was observing star crossings for an astronomical position it was not possible to keep the star image steady in the eye-piece, at about the time of this earthquake.

233. 1949 August 23. 12:24 p.m. $\varphi = 54°.2$ N; $\lambda = 133°.5$ W; M = 6·4. *USC and GS.* This tremor, a strong aftershock of the earthquake of August 20, was felt in the same area. Many other aftershocks were felt, most of them being included in Table 2 because their locations are not positively known. One resident of the Queen Charlotte Islands reported that up to October 1, 107 aftershocks were felt in that area.

234. 1949 OCTOBER 30. 5:42 p.m. $\varphi = 56°$ N; $\lambda = 135°$ W; M = $6\frac{3}{4}$. *USC and GS.* The epicentre was some 70 miles south of Sitka, Alaska.

235. 1949 NOVEMBER 29. 5 a.m. An earthquake was felt slightly at Victoria and in Seattle.

236. 1950 APRIL 14. 3:04 a.m. $\varphi = 48°$ N; $\lambda = 122\frac{1}{2}°$ W. *USC and GS.* An earthquake was felt in Victoria, Ladysmith, Vancouver, Chilliwack, Haney, Abbotsford and White Rock in British Columbia. *Prov.*

237. 1950 APRIL 16. 1:48 p.m. $\varphi = 49°$ N; $\lambda = 129°$ W. *USC and GS.* Recorded at Victoria at 1:48:58 p.m.

238. 1950 AUGUST 24. 6:15 p.m. $\varphi = 49\frac{1}{2}°$ N; $\lambda = 129°$ W. *USC and GS.*

239. 1950 SEPTEMBER 28. 1:47 p.m. $\varphi = 54\frac{1}{2}°$ N; $\lambda = 134\frac{1}{2}°$ W. *USC and GS.* Recorded at Victoria at 1:49:14 p.m.

240. 1950 OCTOBER 7. 11:59 a.m. $\varphi = 50°$ N; $\lambda = 129\frac{1}{2}°$ W. *USC and GS.* Recorded at Victoria at 11:59:21 p.m.

241. 1951 JUNE 2. 10:58 p.m. Slight tremor felt at Alberni.

242. 1951 JULY 20. 2:13 p.m. Slight tremor felt at Victoria.

TABLE 2. EARTHQUAKES RECORDED AT VICTORIA JULY 1948 TO JULY 1951.
(Not located, and not listed in Table 1)

Date	Time at Victoria (P.S.T.)	Distance from Victoria	Remarks
	h m s	kms.	
1948 July 2	7 37 27 p.m.	260	
July 17	2 22 23 p.m.	96	
July 27	5 41 03 p.m.	125	
July 27	6 07 09 p.m.	148	
July 28	2 11 11 a.m.	635	
July 28	2 21 40 a.m.	635	
August 2	2 05 39 a.m.	60	
August 3	3 00 01 a.m.	160	
August 5	2 36 41 a.m.	58	
August 5	4 47 14 a.m.	98	
August 5	7 44 30 a.m.	89	
August 6	3 17 39 a.m.	160	
August 6	5 12 50 p.m.	225	
August 18	12 58 51 p.m.	100	
August 27	5 42 18 p.m.	145	
September 24	2 34 22 p.m.	100	
October 19	7 02 05 a.m.	120	
October 27	4 40 27 p.m.	875	
October 28	6 19 39 a.m.	690	
October 28	6 31 37 a.m.	690	
October 29	0 17 05 a.m.	690	
November 3	8 48 40 p.m.	460	
November 11	12 30 23 p.m.	960	
November 16	5 13 48 p.m.	535	
November 18	0 54 14 a.m.	55	
November 21	7 31 26 p.m.	680	
December 1	5 26 56 a.m.	735	
December 10	3 32 39 p.m.	85	
December 13	11 08 07 a.m.	135	
	11 33 02 a.m.	135	
	11 40 57 a.m.	135	
December 14	10 19 35 a.m.	135	
	10 24 29 a.m.	135	
	11 40 10 a.m.	135	
	1 39 47 p.m.	135	
	1 43 05 p.m.	135	
	1 49 32 p.m.	135	
	1 56 43 p.m.	135	
	2 12 11 p.m.	135	
	2 16 32 p.m.	135	
	3 07 25 p.m.	135	
December 15	0 09 02 a.m.	168	
December 15	8 30 30 p.m.	155	
December 30	10 41 52 p.m.	680	
1949 April 19	10 48 53 p.m.		
April 21	10 47 35 p.m.		
May 2	8 44 33 p.m.		
May 8	8 26 18 p.m.	170	
May 11	12 26 37 p.m.	85	
May 24	6 44 43 p.m.	545	
June 14	8 31 15 a.m.	370	
June 16	2 04 25 a.m.	185	
June 18	3 51 26 a.m.	190	

TABLE 2. EARTHQUAKES RECORDED AT VICTORIA JULY 1948 TO JULY 1951.
(Not located, and not listed in Table 1)—continued

Date	Time at Victoria (P.S.T.)	Distance from Victoria	Remarks
	h m s	kms.	
1949 June 19	6 08 16 a.m.	180	
June 27	1 55 30 p.m.		
July 25	10 40 03 a.m.	55	
	10 44 29 a.m.	55	
July 28	12 16 08 p.m.	1100	
July 29	3 09 20 a.m.	290	
August 5	12 47 38 p.m.	435	
August 5	2 46 59 p.m.	90	
August 8	3 17 24 p.m.	250	
August 8	5 36 44 p.m.	173	
August 12	2 12 50 p.m.	110	
August 12	4 08 34 p.m.	127	
August 15	8 01 21 p.m.	355	
August 15	7 30 54 p.m.	100	
August 15	9 46 06 p.m.	170	
August 18	0 04 57 a.m.	180	
August 19	12 58 59 p.m.	150	
August 19	3 24 14 p.m.		
August 19	3 59 12 p.m.		
August 21	12 50 26 p.m.		Queen Charlotte aftershock
August 21	10 16 45 p.m.		Queen Charlotte aftershock
August 22	4 21 43 a.m.		Queen Charlotte aftershock
August 22	6 59 29 p.m.		
August 23	11 43 35 a.m.		
August 23	6 37 32 p.m.		
August 24	1 53 00 p.m.		Queen Charlotte Islands aftershocks
August 24	2 37 13 p.m.		
August 25	9 26 00 p.m.		
August 26	2 39 40 p.m.		
August 27	1 30 40 p.m.		
September 7	3 37 13 p.m.	112	
September 16	6 32 39 p.m.	345	
September 17	2 20 05 p.m.	185	
September 20	4 19 40 a.m.	540	
October 2	2 32 06 p.m.	975	
October 20	8 07 13 a.m.	235	
October 23	1 00 24 p.m.		Queen Charlotte Islands
October 23	6 34 56 p.m.		Queen Charlotte Islands
October 25	10 20 46 a.m.	115	
October 30	11 24 57 p.m.		
November 13	2 55 44 p.m.	175	
November 13	10 21 58 p.m.	137	
December 2	2 32 41 p.m.	532	
December 14	11 44 01 a.m.	135	
December 15	10 35 14 p.m.	112	
December 17	5 06 02 a.m.		
December 21	5 55 52 a.m.	140	
1950 January 2	2 03 46 a.m.	620	
January 4	4 19 30 p.m.	310	
January 14	7 32 17 p.m.	147	
January 27	9 19 36 a.m.	24	
	9 21 38 a.m.	24	
January 27	1 57 05 p.m.	128	

TABLE 2. EARTHQUAKES RECORDED AT VICTORIA JULY 1948 TO JULY 1951.
(Not located, and not listed in Table 1)—continued

Date	Time at Victoria (P.S.T.)	Distance from Victoria	Remarks
	h m s	kms.	
1950 February 14	10 53 02 a.m.	15	
	10 53 36 a.m.	15	
	12 49 21 p.m.	15	
	12 50 48 p.m.	15	
	1 53 20 p.m.	15	
	1 53 50 p.m.	15	
March 2	6 17 39 a.m.	70	
March 2	12 11 29 p.m.	140	
March 5	6 52 25 a.m.	25	
	7 13 54 a.m.	25	
	7 18 27 a.m.	25	
March 21	1 26 14 p.m.	80	
March 21	1 27 17 p.m.	80	
March 24	11 39 03 a.m.	120	
March 25	12 13 39 p.m.	880	Queen Charlotte Islands?
April 12	10 45 04 a.m.	210	
April 17	9 13 41 a.m.	25	
	9 21 12 a.m.	25	
	9 28 40 a.m.	25	
	10 10 36 a.m.	25	
April 28	12 37 18 p.m.	30	
	12 38 31 p.m.	15	
	12 41 48 p.m.	27	
	12 45 22 p.m.	25	
	12 52 04 p.m.	17	
	12 54 50 p.m.	24	
May 3	8 57 32 p.m.	95	
May 16	11 34 53 p.m.	66	
May 21	0 40 15 a.m.	87	
May 22	11 51 06 a.m.	585	Off west coast of Vancouver Island.
June 30	12 28 09 p.m.	50	
July 4	20 02 15 p.m.	120	
July 15	8 55 33 p.m.	60	
August 24	2 25 20 a.m.		
	2 29 54 a.m.		
August 26	9 47 06 a.m.	66	
August 31	0 02 36 a.m.	180	
September 20	5 21 06 a.m.	660	
September 21	2 25 06 p.m.	122	
September 23	5 58 51 p.m.	290	
September 28	8 35 23 p.m.	33	
September 29	6 58 29 p.m.	33	
	7 20 22 p.m.	25	
	7 21 19 p.m.	25	
September 30	1 20 02 a.m.	25	
October 1	5 07 48 a.m.	1050	Queen Charlotte Islands?
October 1	6 12 58 a.m.	1050	Queen Charlotte Islands?
October 6	10 18 38 a.m.	95	
October 13	1 48 22 a.m.	25	
October 16	11 27 22 a.m.	76	
	11 28 48 a.m.	84	
	11 32 21 a.m.	90	
	11 35 12 a.m.	80	

TABLE 2. EARTHQUAKES RECORDED AT VICTORIA JULY 1948 TO JULY 1951.
(Not located, and not listed in Table 1)—continued

Date	Time at Victoria (P.S.T.)	Distance from Victoria	Remarks
	h m s	kms.	
1950 October 16	12 04 15 p.m.	63	
October 22	9 52 07 p.m.	177	
November 16	9 28 27 a.m.	115	
November 17	3 49 08 p.m.	63	
November 18	12 06 48 p.m.	60	
December 7	12 30 29 p.m.	118	
December 11	3 24 11 p.m.	102	
December 12	2 25 05 a.m.	87	
December 31	3 19 15 a.m.	45	
1951 January 3	5 43 16 a.m.	290	
January 6	8 15 25 p.m.	90	
January 23	3 25 39 p.m.	90	
February 7	10 24 41 a.m.	172	Depth greater than normal?
February 13	4 52 17 p.m.		
February 14	2 00 35 a.m.	650	
February 14	2 18 20 a.m.	650	
March 5	4 26 06 a.m.	102	
March 5	2 27 54 p.m.	170	
March 19	3 35 49 p.m.	42	
March 29	10 20 15 a.m.	40	
April 5	9 58 25 a.m.	72	
April 10	10 05 16 a.m.	33	
	10 06 43 a.m.	40	
	10 40 59 a.m.	33	
	12 27 01 p.m.	26	
April 11	9 11 51 p.m.	88	
April 17	2 58 33 p.m.	33	
	3 00 09 p.m.	40	
	3 01 43 p.m.	40	
	3 03 13 p.m.	40	
	3 04 36 p.m.	40	
	3 05 43 p.m.	40	
April 20	11 16 34 a.m.	33	
May 30	9 26 17 a.m.		
	9 29 12 a.m.		
	9 35 55 a.m.		
	9 48 39 a.m.		
June 17	3 35 35 a.m.	107	
June 26	10 58 30 a.m.	115	
June 27	2 51 46 a.m.		
July 19	10 47 02 p.m.	87	
July 20	8 19 16 a.m.		
	9 00 10 a.m.	38	
	9 16 01 a.m.		
	9 17 01 a.m.		
	9 17 39 a.m.		
	9 29 42 a.m.		
	9 33 22 a.m.		
	10 00 07 a.m.		
	2 00 05 p.m.		
	2 13 50 p.m.		
	2 13 50 p.m.		
	2 14 23 p.m.		

TABLE 2. EARTHQUAKES RECORDED AT VICTORIA JULY 1948 TO JULY 1951.
(Not located, and not listed in Table 1)—concluded

Date	Time at Victoria (P.S.T.)	Distance from Victoria	Remarks
	h m s	kms.	
1951 July 20	3 00 05 p.m.		
July 22	2 00 06 p.m.		
July 22	5 00 06 p.m.		
July 24	11 57 51 a.m.		
July 24	2 27 52 p.m.		
	3 57 58 p.m.		
July 26	1 30 08 p.m.		
July 26	3 00 08 p.m.		