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HISTORICAL SEISMICITY OF NEWFOUNDLAND

by

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EARTH PHYSICS BRANCH OPEN FILE NO. 85-22

Ottawa, Canada, September, 1985

pp. 75 pages
Price/Prix: \$18.25

This document was produced
by scanning the original publication.

Ce document est le produit d'une
numérisation par balayage
de la publication originale.

ABSTRACT

St. John's, Newfoundland, newspapers between 1810 and 1914 were systematically scanned for reports of earthquakes which had been felt but not previously catalogued. No new earthquakes were discovered in this period. The newspapers and other sources were searched to refine the location and size of previously catalogued earthquakes. Three new earthquakes were found: 11 April 1940 magnitude 3.6 near Ramea, 05 January 1956 magnitude 3.5 near Heart's Content, and 28 January 1957 magnitude 3 near Grates Cove. Significant reports were found to modify the parameters of four other known earthquakes. Reports confirming the non-seismic nature of some suspicious events were also found. The confirmed events, together with the high level of earthquake awareness evidenced, confirm the low level of local seismicity observed since the region was closely monitored by seismographs.

Résumé

Les journaux de St-Jean, Terre-Neuve, de la période 1810-1814 ont été examinés systématiquement afin de relever des comptes rendus de tremblements de terre ressentis mais non catalogués jusqu'à maintenant. Aucun nouveau tremblement de terre n'a été découvert. Les journaux et d'autres sources ont été examinés afin de préciser la localisation et la dimension des tremblements de terre déjà catalogués. Trois nouveaux tremblements de terre ont été relevés: le 11 avril 1940, magnitude 3.6 près de Ramea, le 5 janvier 1956, magnitude 3.5 près de Heart's Content et le 28 janvier 1957, magnitude 3 près de Grates Cove. Des rapports significatifs, modifiant les paramètres de quatre autres tremblements de terre connus ont été trouvés. Des rapports confirmant la nature non-séismique de quelques autres événements suspects ont aussi été trouvés. Les événements confirmés associés avec le haut niveau de sensibilisation par-rapport aux tremblements de terre, confirment la faible séismicité locale depuis que la région est activement surveillée par des séismographes.

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INTRODUCTION

by

John Adams
Earth Physics Branch
June 1985

This open file consists of two parts. Part I is the original contract report, reprinted with certain editorial changes that are discussed further below. The contract report was written by M. Staveley in fulfillment of Department of Supply and Services Contract OST83-00157 for Earth Physics Branch, Department of Energy, Mines and Resources, Ottawa. The work was funded by the Office of Energy Research and Development of Energy, Mines and Resources Canada as part of Earth Physics Branch research into seismology and seismic hazard of the eastern continental margin.

Part II includes a review of the information presented in Part I together with a new assessment of the instrumental data for five of the earthquakes.

The changes to Part I include:

- minor editorial changes such as adding titles for the tables, some current Earth Physics Branch parameters on event locations and times, and other notes designed to make the report more directly useful to the reader.
- Appendix I has been condensed to include only the descriptions of the newspapers cited in Part I.
- Appendix IV has been condensed to include only transcriptions of the two Canadian earthquakes in Table 1 (the reference to the Baltimore earthquake is entirely derived from a Baltimore newspaper and so is not included).
- Appendices V - XX, which consisted of photocopies of original reports, have been transcribed and recordered into a new Appendix V, with the omission of certain less relevant material.

Copies of the original contract report will be deposited in the libraries of Memorial University of Newfoundland and the Earth Physics Branch, Ottawa.

Unless otherwise noted the word "Newfoundland" means only the island of Newfoundland exclusive of Labrador, which is also a part of the Province of Newfoundland. Prior to 1949 both Labrador and the island of Newfoundland were politically a colony of Great Britain and were not administered as part of Canada. Therefore some early historical records relevant to the study may be stored in Great Britain and so not immediately available in Canada.

The main task of the contractor was to scan a complete set of newspapers for the time period practicable. By the end of the contract the newspaper record had been scanned from 1810-1818 and 1827-1914. Lack of earlier newspapers, a 9-year gap in issues of the Gazette, and the bulk of the

post-1914 newspapers precluded more extensive coverage. The coverage is shown diagrammatically in Figure 1, which shows clearly the periods not covered as well as those covered by more than one source.

About 29 events in the period 1755 to 1979 were investigated; these included known earthquakes from EPB's list that might have been felt in Newfoundland.

By way of summary, Table 1, lists the events investigated together with the interpretation made in Part II, while Figures 4, 5 and 6 show earthquakes and place names referred to in the Open File.

HISTORICAL SEISMICITY OF NEWFOUNDLAND

PART I: CONTRACT REPORT

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STUDY OF THE HISTORICAL SEISMICITY OF NEWFOUNDLAND

The object of this exercise was to examine documentary evidence, principally newspapers, to elicit information on seismic movements occurring in Newfoundland and adjacent waters. The method was to scan continuous runs of relevant newspapers recording any report of seismic activity. Negative evidence (i.e. no reports) from this source was, in a sense, almost as important as positive evidence. Where there was positive reporting of seismic activity, whether previously known or not, any available supporting evidence (journals, books scientific or quasi-scientific reports) was also examined.

The Availability of Newspaper Evidence

Newfoundland has had a plethora of newspapers through the 19th and 20th centuries. Though it was, in terms of population, a rather small community, it was also highly politicised (sic) and this was reflected in the number of newspapers and broadsheets which were the main medium of public discourse. Most of these papers were published in the capital, St. John's; a few originated in Conception Bay, the only other commercialised region about 40 miles by road and packet boat from the capital. Late in the 19th century one or two papers were published in larger centres of the North-east coast.

Many of these publications, serving factional or regional interests and small populations, were ephemeral. They appeared for a few months or, at most, years and disappeared. Sometimes they enjoyed reincarnation under a different name. But, in general, they do not give both detached and long-run reporting. At the same time, seismic occurrences were good neutral copy, whatever the political or factional stripe of the publication, and there is no prima facie reason to believe that they would be ignored. All the evidence (see below) suggests that prime space would be accorded to earthquakes, tidal waves, etc. Accordingly, the first problem was to select from the mass of material for scrutiny.

Two catalogues of these sources available in St. John's are extant. The first and fullest of these, here called the McDonald Catalogue, lists and describes the newspapers and journals held by the Provincial Archives and the Gosling Memorial Library, the two main repositories of public record in Newfoundland. This list is attached to this report as Appendix I*. The second list records the newspapers and journals available on microfilm in the Queen Elizabeth II Library at the Memorial University of Newfoundland. This list is attached as Appendix II.

As it was clearly impossible to cover all the sources listed, the criteria for selection were length of run, reliability, and complementarity of coverage. The sources selected were as follows:

*Only the relevant parts of Appendix I are included in this open file.
J. Adams

1. Royal Gazette and Newfoundland General Advertiser - Published 1807 - present. Weekly. Longest run paper and, especially in the first three-quarters of the 19th century, the closest thing to an 'official' paper, or paper of record. McDonald notes that "for local coverage, the Gazette relied heavily on 'abstracts of intelligence' from other newspapers, thus providing an extensive coverage, while maintaining their personal approach".
2. Evening Telegram - published 1879 - present. Towards the end of the 19th century, this daily came to have a fuller and more comprehensive news coverage than any other.
3. Daily News - published 1894 - 1984. A daily, chief competitor to the Evening Telegram.
4. Public Ledger - published 1820-1882. Semi-weekly, tri-weekly, and then daily from 1859. A substantial early paper, used in this analysis as a cross check on the Gazette.
5. Newfoundlander - published 1806-84. Weekly then semi-weekly. Like the Ledger used as a cross check on representativeness of the Gazette for sample early period.
6. Twillingate Sun and Northern Weekly Advertiser - published 1880-1892. A weekly, the only substantial paper off the Avalon Peninsula in the 19th century.

The rationale for this range of sources was that the Gazette provided the long-run authoritative news base for the 19th century, with the Ledger and the Newfoundlander used to check its consistency. Towards the end of the century, when the coverage of the rival papers became fuller, and the Gazette became more and more an 'official' organ of state (therefore less newsworthy) the Telegram was used as the basic source. The Daily News was used for one sample period to see if it differed substantially from the Telegram. The Twillingate Sun was used, for its decade or so of publication, to examine local news first-hand outside the capital region.

The periods scanned thoroughly were as follows:

Royal Gazette 1810-1899 (except for 1818-27 missing from Memorial University Library).
Public Ledger 1827-1838; 1850-59; 1870-76
Newfoundlander 1830-1839 (except 1835 and 1836, all issues missing)
Evening Telegram 1880-1900; 1910-1914
Daily News 1901-1909
Twillingate Sun 1880-1883; 1886-1892

All numbers of the papers listed were closely scanned with the exception of editions missing from the collection. Missing numbers are listed in Appendix III. Coverage was slightly more than 96% for the Newfoundlander and Public Ledger, over 97% for the Royal Gazette, and over 99% for the Evening Telegram and Daily News. Although the number of missing newspapers is very small, it does tend to be concentrated, usually in the earlier periods -

nevertheless, the coverage is exceptionally good, and it is improbable that much if any seismic activity has been missed through these gaps.

In addition to this general scanning of the above papers, detailed searches were made of a much wider range of papers around dates of previously known or newly discovered seismic activity.

It should be noted that outside St. John's, Conception Bay, and, in a small way, the North-East Coast, newspapers were virtually nonexistent until the 1930's when one or two began in Central and Western Newfoundland.

The Quality of Newspaper Evidence

The research assistants scanning the paper were instructed to keep records of all or any seismic references whether relating to Newfoundland or not. This was done not for its bearing on the seismic history of Newfoundland itself, but as an index of public awareness and the newsworthiness of seismic activity. It appears that seismic events were considered highly newsworthy and it is a reasonable inference that no local event, however slight, would go unreported. This is certainly true for the latter part of the 19th century. The researchers were also impressed that seismic activity, in whatever part of the world, was reported boldly - it did not get buried in a single column inch on the back page, but a prominent item would be made of it. It appears, therefore, that there is little chance of substantial local seismic activity going unreported.

Items of seismic activity compelling Newfoundland editorial attention were not uncommon. They are presented in chronological sequence, in Table 2.

A couple of qualifications might be made of Table 2. One is that usually, items reported were calamitous or sensational - villages or towns destroyed, or numerous fatalities, were well reported. At the same time there is to a degree a scientific or quasi-scientific curiosity about seismic phenomena. Another point that should be made is that the reporting of occurrences does show some grouping - twelve, for example, in the period 1850-55, and twelve in the period 1894-98. Perhaps this reflects a heightened interest or awareness on the part of particular editors.

One final point on this - when we have two papers to compare for the same phenomenon, we find that in only one case do the two papers report the same occurrence. This was, perhaps not surprisingly, the 9 November 1852 shock felt in England and Ireland. A reasonable inference from this is that generally foreign earthquakes were not necessarily systematically recorded but constituted good matter for the foreign news "filler" of which McDonald speaks so frequently in his Catalogue (see Appendix I). Nothing however, suggests a lack of interest in seismic activity, and it is a reasonable inference that anything occurring in Newfoundland would be reported.

Most of the above incidents reported are carried in Appendix IV*.

*Only the two Canadian events in Appendix IV are included in this Open File. J. Adams.

I have been unable to ascertain with any exactness the nature and dates of newspapers published on the French islands of St. Pierre-Miquelon. This is presently (March 1984) under investigation. There is however a brief but promising article which has been requested by Inter-Library loan: Aubert de la Rue E. "Les tremblements de terre aux iles Saint-Pierre et Miquelon" Annales de Physiques du Globe, France d'Outre Mer. No. 19 (Février 1937) pp. 25-26.

Seismic Reports on Newfoundland*

A number of seismic occurrences, or what were suggested to be seismic occurrences, have been reported by various authorities over the years. Most of these are known to the Earth Physics Branch, Energy, Mines and Resource Canada, but it is possible that one or two relatively recent phenomena were not known - at least they do not seem to occur in the list of references received at the commencement of this contract. The phenomena discussed occurred over a little more than two centuries, 1755-1979. These occurrences are codified and discussed chronologically in the following pages. Any supporting documentation is carried as appendices.

The earthquake and tsunami of November 1929, popularly known as the Burin Tidal Wave, or the Grand Banks Earthquake, is not treated here as sufficient is known for present purposes of its location, duration and effect.

*Refer to Figures 5 and 6 for maps of place names mentioned in Part I.

1755 November BONAVIDA

Event A tidal wave (tsunami) in Bonavista Harbour

Evidence Tocque P. Newfoundland: as it was, and as it is in 1877,
(1878), p. 145. See Appendix V

Tocque claims that "at the time of the great earthquake at Lisbon, in 1755, the effects were felt at Bonavista. The sea retired and left the head of the harbour dry for the space of ten minutes, when it again flowed in and rose to an unusual height, overflowing several meadows, for about the same space of time as it had retired, and the waters on each side of the Cape were greatly agitated".

This gave rise to the folk-song "A Great Big Sea Hove in Long Beach" (19th century) though whether this derives from Tocque's account or from a longer folk memory is uncertain (Fig. 2). The song is definitely attributable to Bonavista (there are many Long Beaches in Newfoundland) by the reference to "Cannaille" in the last stanza: Canaille is a section of Bonavista town in the western part of that settlement. The attached plan (Fig. 3) of 18th century Bonavista shows "Corniel Rock" just off the portion of the town now known as Canaille.

Tocque's authority is uncertain. Bonavista, one of the two or three chief towns off the Avalon Peninsula would have been relatively well settled in 1755 - it had an Anglican minister resident from 1725 (see Tocque) - and had a solid record of trading and settlement going back to the 1670s. If the phenomenon did occur "at the time" of the Lisbon earthquake i.e. 1 November, the population would have been down as it is probable that many people would have returned to England for the winter - but even so, there must have been a wintering population of the low hundreds by then and plenty of eyewitness capacity.

There is a possibility that any such phenomenon could have been associated with an earthquake in the same year in Boston.

1775

BURIN

Event

Alleged Earthquake killing 300 people

Evidence

Gregory, J.W. "The Earthquake of the Newfoundland Banks of 18 November 1929" Geographical Journal, 78, 2 (1931) pp. 123-139, See Appendix V.

"The earthquake in 1774, which caused a death roll (sic) of over three hundred in the Burin Peninsula of southern Newfoundland, may have had its origin in earlier movements of the Cabot Trench". (Gregory p. 133)

It is difficult to place any credibility in this account. A disaster of such magnitude would have surely come down in folk legend and no such folklore seems to exist. In any case, it is arguable whether there were three hundred people in the Burin area in 1774 - at least we can say that such a catastrophe would have wiped out nearly all the population.

It is probable that Gregory is, without warranty, focussing too narrowly the importance of another statement without attribution, which is cited in "Earthquakes in Eastern Canada and adjacent areas", Proceedings of The Royal Canadian Institute, 1937 (see Appendix V) - in the aftermath of the 1929 Grand Banks earthquake, "investigation of early records" was stimulated. "It was found that, in 1774, there was a tidal wave in the Lower Gulf resulting in 300 deaths". There is, however, no evidence to associate this with the Burin Peninsula.

[In a letter dated 9 July 1985 (EPB file 6265-20), M. Staveley included the 1775 Governor's report (see Appendix V) and the following comments

"I think it is clear from these documents that Prowse must be referring to the September 1775 storm described in the Governor's report; that he was correct in calling it a storm, and the 'tidal wave' effect was in fact the phenomenon of storm-driven waves, possibly in conjunction with normal high water (or springs). More detailed research might establish whether the 'Storm of Wind' concided with an unusually high tide. At any rate, it is clear from the Governor's letter that the phenomenon was widely distributed and it seems unlikely that it was a 'tsunami'".

"The 'Three Hundred' perished is also worthy of note - the Governor's figure is, of course, 'not under' three hundred, but the round figure has obviously become enmeshed in folk memory as the figure and Prowse uses it. I also suggest, from this piece of evidence, that this is likely to have been the same phenomenon as was previously reported for Burin in 1774. You will recollect that Gregory appears to have transposed to Burin the tale of a 1774 tidal wave in the Lower Gulf which killed 300 people. I suspect that the 1775 storm in the Lower Gulf (incl. Nfld.) killed around 300 people and that the two events are one and the same - and not earthquake related."]

1809, 1836, 1857 LABRADOR

EVENTS

Miscellaneous tremors at various locations along the Labrador Coast.

21 January 1809 and following days "Some shocks" (Moravian); "severe shocks" (Gosling)

30 November 1836 "smart shock" at Hopedale

12 January 1857 "smart shock" (Moravian); "earthquake shocks" at Hebron (Gosling).

Evidence

Gosling W.G. Labrador: its discovery, exploration and development (1910) pp. 285, 286, 295, 300. See Appendix V for relevant extracts.

Periodical Accounts relating to the Missions of the Church of the United Brethren established among the Heathen vols. 4 (1806), 14 (1836), and 22 (1856).

Gosling was a sober and upright St. John's businessman whose work is fairly well regarded. Perhaps more important, his references come from an unusually reliable source, the Moravian Brethren, who since 1757 had conducted a Mission on the Coast. We know that the Brethren had a reputation for interest in natural phenomena - for example, from the 1770s or 1780s they kept fairly continuous daily weather records using two types of thermometer calibrated by scientific societies in London and Berlin (ongoing work of A.G. Macpherson, Department of Geography, Memorial University). In addition, they had a close and necessary interest in wind, sea and ice conditions as their mission ship, the Harmony, made annual service and trading visits and was their lifeline to the outside world. For all these reasons, they kept good documentary records, many of which survive. These accounts exist in two forms: the daily manuscript records of the mission stations kept largely in German, and annual digests of the Mission published in English. Both are retained in Memorial University Library.

The published accounts are carried in Periodical Accounts relating to the Missions of the Church of the United Brethren established among the Heathen vols. 4 (1806), 14 (1836), and 22 (1856). Each volume was published for a number of years and the date of publication refers to the first year treated - this explains why, for example, events described for 1809 appear in a work with an 1806 imprint.

The Periodical Accounts substantiate Gosling's account - and they give more precise, more accurate and fuller descriptions of what took place. See Appendix V. Gosling appears to have followed this Moravian source quite closely though sometimes he has embellished it, and sometimes transposed the descriptions. For example, the 1809 phenomenon of 21 January is described by Gosling as "severe shocks" but the Moravian account simply says "some shocks" and tells us that the observation originated in Nain. The 30 November 1836 phenomenon gets much fuller treatment in a Moravian footnote, which extends the region in which the shock was felt from Hopedale to Nain and describes its duration and nature - "accompanied with a subterranean rumbling noise, resembling thunder".

Cont.

1809, 1836, 1857 LABRADOR (Cont.)

The 1857 shock is very lightly mentioned by Gosling. But the Periodical Accounts give more detail - it was pinned down to 12 January, it was again a "smart shock" and it caused the natives to run in alarm out of their huts.

The Moravians are a useful, even critical source - for not only were they lettered and quasi-scientific, but they were spatially organized and communicated with one another up and down the coast, exchanging observations on the human and natural phenomena of their territory.

The footnote to the 1836 occurrence relates that the detailed account of that phenomenon was based on "private correspondence of the Missionaries". This material is probably included with the second source of evidence, the daily manuscript accounts kept by each mission. Many of these survive and part of the diary for Nain for January 1809 has been seen. It has not yet been transcribed let alone translated, but when this is done it, and any others found, will be incorporated into the record. [Note: this work is intended for 1985-1986.]

1837 circa BONAVIDA (neighbourhood)

Event Strange, protracted sound resembling "distant thunder" followed two days after by heavy ground seas.

Evidence Tocque P. Newfoundland: as it was, and as it is in 1877, (1878), p. 145. See Appendix V

A very slight and imprecise attribution as to timing - "winter season ... about forty years ago." But the description is fairly full, as to nature, duration and distribution of the phenomenon. The reference is given in Tocque pp. 144-145. See Appendix V. Tocque was published in 1878, but wrote in 1877, and "forty years ago" would give a date c. 1837. The description occurs immediately preceding the reference to the Lisbon earthquake, and, given its relative closeness to the time of writing and fullness of description it is perhaps more credible. The population of the area at the time would be in the order of 3000 persons.

Tocque states specifically that there was "no trembling nor the slightest motion was felt in the earth" - but the information about "one of the heaviest ground seas ever known" occurring two days afterwards leaves open the question of whether this might have been a submarine seismic occurrence.

A further speculation - Tocque gives the inhabitants' description of this phenomenon as "the thunder-growl". Can this be associated with the very similar description of the 1836 Labrador phenomenon (see previous page) which occurred about forty years before Tocque wrote, in the winter season and was characterised by a "subterranean rumbling noise, resembling thunder"?

1864 June 27 ST. SHOTT'S
June 27, 19h local time

Event A tidal wave at St. Shott's, near Trepassey, southern Avalon

Evidence Smith W.E.T. Earthquakes of Eastern Canada and adjacent areas 1534-1927, Publications of the Dominion Observatory, 26, 5 (1962).
Devine, P. and O'Mara Notable Events in the History of Newfoundland, 1900
Newspaper Reports

Smith's account is a brief note that at 7:00 pm on 28 July 1864, a "shock" off the Newfoundland coast caused a tidal wave at St. Shott's. The derivation is said to be "a letter from a resident of Newfoundland". We have been unable to trace this letter.

Devine and O'Mara give much more detail - recording the extent of withdrawal of the sea with reference to a wreck normally below 5 fathoms of water, and the catastrophic return of the waters. However the date given was 18 June, again at 7:00 p.m.

Devine and O'Mara are known to be not wholly accurate - their snippets of information were derived from gossip or from contemporary newspapers. Therefore the news sheets for the period were closely scrutinised. Two reports were found - in the Public Ledger and the Telegraph. The Ledger gives the data as Monday 28 June; the Telegraph gives it as Monday 27 June - both at 7:00 p.m.

How can we pin down more accurately the timing of this occurrence? Probably fairly simply - the original reference is the Telegraph which gives Monday 27 June. The Ledger took its story from the Telegraph but misprinted the date, for Monday of that week was in fact the 27th. Devine and O'Mara copied the story from the Ledger but misprinted the 28th as the 18th! Smith, or his source, used the 28th as a date, but placed it in the wrong month because he (they) misread the meaning of the rather archaic term "ulto". - he read it as "this month" whereas it meant "the previous month".

Thus, the correct time and date of the occurrence was probably Monday 27 June 1864 at 7:00 p.m. local time.

As to the nature of the occurrence, again the fullest description is found in the earliest record found (Telegraph, IX, 28, p.3, 13 July 1864) which briefly but graphically describes the receding of the sea, the uncovering of the wreck of H.M.S. Little Drake and the ensuing tidal wave with the damage and shoreline modifications wrought. It ends with the interesting observation "No doubt a severe submarine volcanic eruption has taken place in some place not very remote from our Southern Shore".

There are interesting parallels between this account and eyewitness accounts of the 1929 tsunami - see letter of Dr. T. F. Nemeo to Anne Stevens dated 11 January 1977. Again "the sea withdrew exposing the ocean floor and

cont.

1864 continued

later rushed back with sufficient force..." It would be interesting to know from further eyewitness questioning as to whether H.M.S. Little Drake was exposed (or if it still exists intact) - that might give a benchmark for the comparative magnitude of the 1864 occurrence. I shall ask Dr. Nemeč, who still has very strong family associations with St. Shotts, to enquire about this when he is down there again. All citations used in this account are carried in Appendix V.

1884 March 18 NORTHERN AVALON PENINSULA
March 18, 13:15 local time

Event Earth Tremors and atmospheric explosions/rumblings 18 March 1884 c. 1:15-1:45 p.m.? St. John's; N. side of Conception Bay, S. side of Trinity Bay, Harbour Grace Junction (now Whitbourne), Placentia Bay.

Evidence cited in Smith W.E.T 1962 and Dawson W.J. "Our record of Canadian Earthquakes", The Canadian Record of Science, VI. (1894-95) p. 15. Newspaper evidence is quite strong on this occurrence - Appendix V carries reports from the Evening Telegram, Terra Nova Advocate, Newfoundlander, and Standard and Conception Bay Advertiser.

The evidence may be read directly from the newspapers but in brief the disturbance seems to have been felt most strongly in the Bay de Verde Peninsula between Harbour Grace in the east and Heart's Content in the west. Although Dawson lists St. John's as a locality experiencing this occurrence, this is not clear from the newspaper reports - the Terra Nova Advocate for 20 March reported the occurrence in Conception and Trinity Bays but not in St. John's and added "we anxiously await further particulars of a phenomenon of such rare occurrence in this colony" (emphasis added). Then on 22 March, the Advocate reported that some excursionists out from the city had experienced the shocks, and on 25 March carried a cryptic and sardonic account of a mythical seismic phenomenon printed, I suppose, for personal and/or political reasons. Both these latter accounts imply, however, that the 18 March tremor was not seriously felt, if at all, in the city of St. John's itself. The sound may have been heard in St. John's.

The tremor reached as far south as Black River, in the northern part of Placentia Bay, and as far north and west as Trinity. But, the serious tremors seem to have been confined to the peninsula between Heart's Content and Clarkes Beach or Brigus.

I have been unable to find any clear evidence which would give warranty to Dawson's statement that the occurrence was one of "movement north to south". The only clear directional information is in the direction of the explosion - from Harbour Grace, "a heavy report issu(ed) from the heavens, apparently in (from?) a S.W. direction". The "rumbles" and "angry and prolonged detonations" went on for about four minutes at Harbour Grace, but only "thirty seconds" at Brigus.

I searched the Twillingate Sun to see if there was any northern limit to this phenomenon but, unfortunately, the 1884 edition was one of two years missing from our collection. However, I did find in the Evening Telegram (7 April 1884) a report of the log of Captain Blandford, just returned from the seal hunt. On 18 March, Blandford had been at the Funk Islands, N.E. of Fogo and north of Cape Freels. His log was a characteristically brief but accurate account of weather and ice conditions and he reported nothing untoward for the date of the occurrence. If any seismic phenomenon had occurred in that location, I would expect it to have been observed and recorded in this log.

1884 October 04 SOUTHEASTERN SLOPE OF NEWFOUNDLAND BANK

Event Cable breaks attributed to submarine landslide 4:00 a.m., 4:08 a.m. and 8:00 a.m. 4 October 1884 between 46° to 50° W longitude.

Evidence Milne J. "Sub-Oceanic Changes", Geographical Journal, 2, X (1897) pp. 137 ff.
Heezen B.C. and Ewing M. "Turbidity currents and submarine slumps and the 1929 Grand Banks Nfld. Earthquake", American Journal of Science, 250, 12 (1952) pp. 849-873.

"three cables running in parallel lines ten miles apart broke at points nearly opposite to each other, on the same straight line". The phenomenon was attributed, cautiously, to a "slump or turbidity current" by Heezen and Ewing, who suggest a similarity between this occurrence and that of the 1929 Grand Banks earthquake. See Appendix V.

No effects were reported in Newfoundland. The regular papers (see Introduction) were searched, together with the Evening Mercury, Our Country and Harbour Grace Standard for dates around 4 October 1884.

1890 July 23

ST. JOHN'S

Event

? shocks of earthquake, Signal Hill, St. John's, 7:00 a.m.
23 July 1890.

Evidence

Devine P. and O'Mara Notable Events in the History of
Newfoundland 1900, p. 139. See Appendix V.

Devine and O'Mara are the only source for this occurrence. They simply record that a signal man, M. Cantwell, at the Signal Hill Blockhouse (alt. 525 feet) "felt two shocks of earthquake" at 7:00 a.m.

This is a source of slight credibility without supporting evidence. The citation before this entry tells us that this was the day of the St. John's Regatta, arguably the most festive day in the city's social calendar. At 6:00 a.m. on the morning of each Regatta day, the Committee meet at Quidi Vidi Lake to assess the weather and decide whether the Regatta should go ahead. On 23 July 1890, the Regatta took place, and the championship time was rowed at 9:30 a.m. Between 6:00 a.m. and 9:30 a.m., there must, in other words, have been a substantial amount of human activity around Quidi Vidi Lake which lies at the foot of the Signal Hill range, only 1/2 mile from the Block House, and in clear sight of it.

There is no supporting newspaper evidence. The regular papers plus the Times and General Commercial Gazette, Patriot and Terra Nova Herald, Standard and Conception Bay Advertiser, Terra Nova Advocate and Evening Herald were searched around the date, but no supporting evidence was found.

In light of this dearth of evidence, and the fact that so many people were likely to be around so close to the supposed occurrence, a very low credibility must be attached to this account.

There were cable breaks in 1890 but "there is no record to show that these were caused by earthquakes" (Hodgson, see Appendix V under 1774).

1907 January 20 OLD PERLICAN

Event Tidal Wave

Evidence Brief report in Evening Telegram for 20 January 1907 referring to a recent "big tidal wave which ... swept our coast". See Appendix V. No other reports yet found.

The tone of the report implies an unusually high level of the tide as much as it does a single wave.

1909 December 20 CAPE BRETON

Event Shock felt throughout Cape Breton, 19/20 December 1909

Evidence For Newfoundland, none

No reference to Cape Breton phenomenon in Daily News or Evening Telegram. Two reports in Evening Telegram for 22 December may have a connection, but at best a tenuous one. The report of "Stages swept away" at Lower Island Cove, Conception Bay tells of a "very high sea" which might mean a tidal wave. But the immediately succeeding report about the arrival in St. John's of the S.S. Kamjford (which left Sydney on "Saturday morning" - presumably before the shock) implies that the general weather situation was unusually stormy. It is likely that the extremely high seas were therefore a weather rather than a seismic condition. See Appendix V.

1922 July 26 c. 50°00'N 50°00'W (approx. 300 km NE of Newfoundland)

Event Seismic waves recorded by instruments

Evidence EMR listings of instrument recordings give a magnitude 5.3 seismic occurrence on 26 July 1922 at this location. There are no Newfoundland newspaper reports of seismic or related activity for this period - the two major papers, the Evening Telegram and Daily News were searched without result.

1924/25 BONNE BAY, west coast of Newfoundland

Event Tidal wave

Evidence A report in Daily News of 27 November 1929 discussing 1929 Grand Banks earthquake. Dr. L.M. Green of Deer Lake was quoted as reporting "a tidal wave of considerable velocity" in part of Bonne Bay in 1925 and earth tremors in March 1924. See Appendix V. No more precise data are given.

A thorough search was made of the Evening Telegram for reports on the Charlevoix earthquake of 28 February 1925 on the suspicion that any "tidal wave" may have resulted from this phenomenon. The Charlevoix earthquake was well reported for a number of days (2 March, 3 March (4 different wire stories), 7 March and 9 March) but no local phenomena were reported even though the Telegram was searched thoroughly to 14 March.

Other searches were made of the Daily News, Newfoundland Weekly, Fisherman's Advocate and Daily Globe with no reports of local phenomena found. The Fisherman's Advocate for 6 March reported the Charlevoix earthquake, and the 27 March number gave an account of another quake 21 and 22 March in Ottawa and Quebec City.

It is possible that Dr. Green's report was of a 1925 phenomenon not associated with the Saguenay at a different time of year. And the "1924" tremor may have been a distant but unreported side effect of the Saguenay incident. Dr. Green was the general practitioner in Lomond in 1924, a well-thought-of citizen, a native of Ontario. By 1929 he had moved his practice to Deer Lake. I intend to enquire further into this through his son, a resident of St. John's, and through local oral history.

1934 June 15

LABRADOR SEA

Event

Earthquake, magnitude 5.6, June 1934

Evidence

Taylor A.E., Judge A.S. and Wetmiller R.J. "Two risks to Drilling and Production off the East Coast of Canada ..." Symposium on research in the Labrador Coastal and Offshore Region, Memorial University, 8-10 May 1979.

No other local reference was found to this phenomenon. The Evening Telegram was searched for the whole of the month of June 1934 - the only reference to earthquakes was a report in the 11 June number of an occurrence in Iceland.

1940 April 11

SOUTHWEST COAST

April 11 01h local time

Event

Severe earth tremors felt at a number of places on the South West Coast including Rencontre West, Francois and Burgeo at about 1:00 a.m. local time, 11 April 1940.

Evidence

Evening Telegram: 12 April 1940. See Appendix V. Said by some residents to be "louder" or "more severe" than 1929 phenomenon. Houses heavily shaken. This seems to have been a significant event of some duration and spread. It is not listed in the EMR listings of Instrumented Events. [New event, not previously catalogued.]

1951 June 27

45°N 57°W (approx. 200 km south of Newfoundland)

Event

Earthquake of estimated 5.0 magnitude 27 June 1951 at 1317 GMT

Evidence

EMR listings of Instrumented Events
No mention in Evening Telegram, the fullest and most reputable of contemporary newspapers.

1954 August 28

45°10'N 56°52'W

Event

Earthquake of 5.2 magnitude 28 August 1954 at 1523 GMT

Evidence

EMR listings of Instrumented Events
No mention in Evening Telegram

1954 October 16 44°50'N 56°48'W

Event Earthquake of 5.3 magnitude 16 October 1954 at 0645 GMT

Evidence EMR listings of Instrumented Events
No mention in Evening Telegram

1956 January 05 NORTHERN AVALON PENINSULA
January 5, 1450 GMT

Event Mild earth tremor along shores of Conception and Trinity
Bays, 11:20 a.m. local time 5 January 1956.

Evidence Reported in Evening Telegram 6 January 1956.
Western Star 6 January 1956. See Appendix V.

Residents reported a phenomenon of tremors and "rumbling like thunder" for one and a half minutes. The occurrence was said to be very similar to the 1929 Grand Banks phenomenon though "milder" in scope. No damage was reported. The nature of this occurrence, and its area, were very similar to those described for the 1884 phenomenon. The 1956 phenomenon is not listed in the EMR list of Instrumented Events. [New event, not previously catalogued.]

1957 January 28 FRANCOIS

Event Steam pouring from ground at Francois, South Coast.

Evidence Report in Daily News for 28 January 1957.
Subsequent stories in:
Observer's Weekly 2 February
Evening Telegram 4 February See Appendix V
Observer's Weekly 7 February

Report of 'Steam pouring from ground at Francois'. Self-explanatory as far as it goes, though it should be read in the context that the winter of 1957 was the hardest and coldest in (still) living memory. (Added by J. Adams from a letter 05 August 1985 from Michael Staveley, EPB file 6265-20.)

1957 January 28 Grates Cove, Bay de Verte

Event Loud rumblings accompanied by earth tremors.

Evidence Reported in Daily News 28 January.

I could find no further report commentary on the Grates Cove phenomenon. I searched the Evening Telegram inch by inch, from 28 January through 9 February with no result. I also searched the Grand Falls Advertiser for 31 January, 7, 14, 21, 28 February, 7, 14, March; and the Fisherman's Advocate for 1, 8, 15, 22 February, 1, 8, 15 March.

There was no further mention of the Grates Cove story. These were the only local newspapers remotely connected with the area. There was no paper in the Harbour Grace - Bay-de-Verte Peninsula at that time, but the Fishermen's Advocate was published in Port Union, just 20 miles across the mouth of the bay from Grates Cove. The Advocate was an exceedingly local paper with strong outport/fishery matters reporting--although Grates Cove would not normally have come within its ambit (it was much more concerned with the Trinity-Bonavista Peninsula), it would be surprising if a significant phenomenon had occurred at Grates Cove and yet gone unreported. At the very least we can be sure that if anything happened at Grates Cove, it was not experienced 20 miles N.W. at Port Union. (Added by J. Adams from a letter 05 August 1985 from Michael Staveley, EPB file 6265-20.) [New event, not previously catalogued.]

1965 November 15 BONAVIDA PENINSULA
November 15, 1112 GMT

Event Tremor of 4.0 magnitude at 49°22'N 53°40'W
c. 8:00 a.m. local time 15 November

Evidence EMR listings of Instrumented Events
Evening Telegram 16 November 1965 (see Appendix V)
Gander Beacon 17 November 1965 (see Appendix V) - carried
also in Grand Falls Advertiser, 15 November 1965
Classed by reports as a "small" or "mild" tremor.

1969 February 02 NORTH CENTRAL NEWFOUNDLAND
February 02, 0424 GMT

Event Slight tremors widespread over area 2 February 1969 1:00
a.m. local time. EMR listing: 49.71°N, 55.13°W, 04:24 GMT,
magnitude $m_b(Lg)$ 3.5

Evidence Report in Evening Telegram 3 February 1969. See Appendix V.
Tremor recorded by Memorial University seismograph. "Noise
and a shaking of the ground" reported. Magnitude according
to E.M.R. listing 3.5. Thought to be centred on Notre Dame
Bay.
Other reports in Grand Falls Advertiser and Gander Beacon
for 3 and 5 February.

1969 August 05 OFF NORTHEAST AVALON COAST

Event Seismograph record of 3.4 occurrence at 21:53 GMT on 5 August 1969. 47°39'N 52°18'W

Evidence Recorded in EMR listing of Instrumented Events. No record in Evening Telegram

1971 December 07 LABRADOR SEA

Event Earthquake of magnitude 5.6. EMR listing: 55.09°N, 54.51°W, 12:04 GMT.

Evidence Taylor A.E., Judge A.S. and Wetmiller R.J. "Two risks to Drilling and Production off the East Coast of Canada..." Symposium on Research in the Labrador Coastal and Offshore Region, Memorial University, 8-10 May 1979. No local reference to this phenomenon.

1975 March 23 OFF FORTUNE BAY/BURIN PENINSULA

Event Seismograph record of 3.2 occurrence at 1513 GMT on 23 March 1975. 47°50'N 55°14'W.

Evidence Recorded in EMR listing of Instrumented Events, and reported felt. No record in Evening Telegram

1975 October 06 SOUTH OF BURIN PENINSULA

Event Seismograph record of earthquake, magnitude 5.2; occurrence at 2221 GMT on 6 October 1975. 44°42'N 57°04'W.

Evidence Recorded in EMR listing of Instrumented Events No record in Evening Telegram

1979 July 20 SOUTH OF BURIN PENINSULA

Event Seismograph record of earthquake, magnitude 3.7; occurrence at 2145 GMT on 20 July 1979. 44°45'N 56°14'W.

Evidence Recorded in EMR listing of Instrumented Events No record in Evening Telegram

APPENDIX I

History of Newfoundland Newspapers

[Taken directly from: Chronological List of Newfoundland Newspapers in the Public Collections at the Gosling Memorial Library and provincial Archives Compiled by Ian McDonald.]

- Notes:
- The first set of dates given after each entry indicates the probable run of the newspaper. If one of these dates is followed by an oblique (/) it signifies that the date is certain.
 - The second set of dates in parentheses indicate the run for which papers are available but does not signify that volumes for each year between these dates are necessarily available.
 - When the date of only one year is given it indicates that the volume for that year is the only one available.
 - With regard to comments upon the political complexion of the newspapers it is to be stressed that especially for the more durable papers these remarks have validity only for a short period of time in the newspapers' histories. The remarks are not meant to be in any way exhaustive and to place any degree of academic reliance upon them would be dangerous.
 - In several instances information regarding ownership or editorial control is not given because it was not readily available and to have sought it out would have demanded a major research undertaking relative to the broad scope of the several tasks being carried out by the writer within the framework of the newspaper project. For the same reason it is unlikely that the information following is completely free of error.
1. Newfoundlander, Weekly, then Semi-weekly, St. John's, est. 1806-1884(6) (1827-84).
- Editors and Proprietors. First published by John Shea then by Ambrose and Ellen Shea until October 18, 1844, then by Ambrose Shea till February 2, 1846 and then by Ellen and Sir Edward Dalton Shea, M.H.A. 1848, 1855-65, Legislative Councillor 1866-1869 and retired to contest an election, re-appointed 1873 and colonial Secretary till 1883 when he became President of the Council.
 - 4 page issues containing local and foreign news from U.K., Europe and West Indies, shipping news and the Proceedings. Liberal and supports Roman Catholic opinion; in opposition to the Public Ledger and Patriot; ardent supporter of responsible government especially after 1850 (C.L.A.) principal confederate newspaper and supporter of the coalition in the 1860's and later supporter of the railroad. In short, the organ of Sir Edward Dalton and Ambrose Shea.

2. Royal Gazette and Newfoundland General Advertiser, St. John's, 1807/-1924/(1810-1967). Became the Newfoundland Gazette from 1926 till the present. Weekly.
 - Publishers and proprietors: 1836-1847, Ryan and Withers; 1848-1885 John Collier Withers.
 - Semi-official publication with a detached editorial policy. Ryan was a Loyalist who came to Newfoundland from New Brunswick after being assured of Government and mercantile patronage for the paper - the first in Nfld. The Gazette published all official announcements and proclamations etc., as well as budgets, important speeches, summaries of official studies, census reports and the like. For local coverage the Gazette relied heavily on 'abstracts of intelligence' from other newspapers, thus providing an extensive coverage, while maintaining their impersonal approach. (C.L.A.)

3. Newfoundland Mercantile Journal, St. John's, Weekly, 1816-27 (1816-1827).
 - Printer, Publisher, Proprietor: Donald McPheeLee after Haire & Lee.
 - Foreign news filler, local commercial news and advertising, formed the bulk of the papers material. The Journal appears to have been apolitical, at least in the earlier period.

27. The Standard and Conception Bay Advertiser, Weekly, Harbour Grace. Apparently established in 1859 since Vol. 4 is 1863. (1860-1894) Became The Harbour Grace Standard & Conception Bay Advertiser 1868.
 - Editors and Proprietors: William Squarey till 1869. Robert Thomas Squarey until March 1875 and apparently Archibald Munn thereafter.
 - The paper carried the usual format though it was more concerned with local issues in Conception Bay, and 'although it was liberal in outlook the paper was more concerned with progress than with politics as it advocated "measures calculated to benefit the community"'. (C.L.A.) Indeed the editors were very flexible in their approach to technical innovations and advocated many concerned with improving the fishery through division of labour, artificial fish-breeding, etc. The paper also encouraged an version of counter cyclical budgeting through retaining road grants until the fishery was completed. Government subsidization of freight rates to encourage exports, rehabilitation and development of exports and government research grants for "new fishing ledges" were also called for. The approach of the paper to the Confederation issue however, was distinctly lukewarm and cautious.

28. St. John's Daily News and Newfoundland Journal of Commerce, Daily, St. John's, 1860-1880 (1860-1880) becomes St. John's Daily News on November 16, 1864.

- Editor and Proprietor: Edited by Robert Winton after April 1861 when his brother Francis resigned as Co-editor.
- Aside from carrying the items making up the format usual to the papers of the day, this one had the dubious distinction of being one of the most extreme of the period.

Without doubt Francis Winton left the Daily News because of profound political differences with his brother, as the later pitched battles between their two papers would testify. Robert Winton was a leading Confederate and prominent in the campaign against C.F. Bennett in which the Daily News proved a ready weapon of the former. Nor did Winton scruple to use his editorial columns as a vehicle for his ultra-protestant and conservative opinions and to support the Orange Order of the 70's and Whiteway.

37. The Terra Nova Advocate and Political Observer, Semi-Weekly, St. John's, 1876-1889 (1876-1889)

- Editor and Proprietor: Joseph English. May 8, 1880-
" " James Jerve Conroy. 1881-1885
- The Advocate had the customary format. Reputedly established with the aid of the Roman Catholic Bishop, the editor followed a Catholic line in politics. Though Liberal the paper was opposed to the Sheas and the Confederate Newfoundlander. It was also naturally enough opposed to the Orange organization and frequently took to task the Evening Mercury and Twillingate Sun.

41. The Evening Telegram, Daily, St. John's, 1879/-1967 (1879-1967)

- Proprietor: Wm. J. Herder; Editor: A.A. Parsons.
- The Telegram was a large daily containing local and foreign coverage as well as advertisements and accounts of the Legislative proceedings. Its only close rival in slanderous articles and sensationalism was the Daily News. Though protestant politically the paper opposed the Orange Order and supported Bennett. It later supported Goodridge against Whiteway and opposed the railway in the 80's but supported it in the 90's. It eventually came around to Whiteway's support in the early 90's.

42. The Twillingate Sun and Northern Weekly Advertiser, Weekly, Twillingate, June 24, 1880/-1892 (1880-1892)

- Editor, Proprietor and Printer: J.P. Thompson.

- The Twillingate Sun had the usual format common to the day but was more interested in North Shore News and improvement. The editorial policy was apparently geared to support of the Church of England but remained relatively innocuous until 1883 when the paper defended the Orange Order. On the whole the paper was apolitical.

57. The Western Star, Semi-Weekly, Bay of Islands, April 4, 1900/-1966, (1900/-1905 then 1947 to present)

- Editor and proprietor: In 1900, W.S. March and in 1948 Western Publishing Co. at Corner Brook.

- This paper had the usual format for a large non-St. John's paper and was politically independent in 1900, while neutral on Confederation in 1948.

61. The Fishermen's Advocate: Weekly then daily. Coakerville, February 12, 1910/-.

- Editor and Publisher: by Sun Printing Co., Twillingate until March 26, 1910 and then printed by Barnes Printing, St. John's and after September 3, 1910 issued from St. John's. From August, 1911 the paper was published by Union Publishing Company, wholly owned by Shareholders who were also members of the Fisherman's Protective Union. Coaker was the editor throughout. The Fisherman's Advocate became a daily in 1913. In 1914 the paper was renamed the Mail and Advocate with daily and weekly editions. In December 1916 the name was once more changed, this time to The Evening Advocate. In 1917 a morning edition called The Morning Advocate was attempted but apparently was only from January to June of that year. In 1924 the Advocate moved to Port Union and reverted to a weekly edition.

88. Grand Falls Advertiser: Daily, Grand Falls, 1946-1967 (1946-1967)

- Publisher: Blackmore Printing.

- The Advertiser has the same basic format as the contemporary Evening Telegram and in the 60's at any rate, it is an uncritical and enthusiastic supporter of the Smallwood administration.

99. Gander Beacon, Weekly, Gander (1959-1967)

- Publisher: Blackmore Printing.

- This newspaper has the format of a daily with a higher concentration on local news and is an avid Smallwood supporter.

CHRONOLOGICAL LIST OF NEWSPAPERS ON MICROFILMin the Queen Elizabeth II Library at Memorial University of Newfoundland

1.	1810-1900	Royal Gazette & Nfld. General Advertiser .
2.	1825-1827	Mercantile Journal.
3.	1827-1882	Public Ledger
4.	1827-1884	Newfoundlander.
5.	1832-1895	Times & General Commercial Gazette
6.	1834-1890	Patriot & Terra Nova Herald
7.	1836-1845	Sentinel
8.	1841-1842	Newfoundland Vindicator
9.	1843-1845	Newfoundland Indicator
10.	1844-1878	Courier
11.	1844-1846	Star and Nfld. Advocate
12.	1845-1854	Weekly Herald & Conception Bay General Advertiser
13.	1846	Mercury & General Advertiser
14.	1846-1862	Morning Post
15.	1851	Banner of Temperance .
16.	1851-1864	Newfoundland Express
17.	1852-1853	Pilot
18.	1856-1859	Conception Bay Man
19.	1856	Reporter
20.	1859-1893	Standard & Conception Bay Advertiser
21.	1862-1865	Day Book
22.	1862-1863	Record
23.	1862-1873	Telegraph
24.	1865-1881	Morning Chronicle
25.	1866-1872	Express
26.	1871-1875	Semi-Weekly Chronicle (with Nfld. Indicator)
27.	1872-1881	North Star
28.	1876-1890	Terra Nova Advocate
29.	1880-1894	Twillingate Sun & Northern Weekly Advertiser
30.	1882-1889	Evening Mercury
31.	1883-1885	Our Country
32.	1878-1880, 1885-87	Temperance Journal
33.	1886-1892	Colonist
34.	1888-1935	Methodist Monthly Greeting
35.	1889-1958	Diocesan Magazine
36.	1890-1910	Evening Herald

37. 1892-1893 Daily Tribune
38. 1901-1910 Trade Review
39. 1903-1979 Among the Deep Sea Fishers
40. 1907-1912 Evening Chronicle
41. 1910-1980 Fisherman's Advocate
42. 1914 Daily Mail
43. 1914-1916 Mail & Advocate
44. 1915-1921 St. John's Daily Star
45. 1917 Morning Advocate
46. 1917-1924 Evening Advocate
47. 1923-1924 Daily Mail
48. 1924-1926 Daily Globe
49. 1924-1932 Newfoundland Weekly
50. 1934-1962 Observer's Weekly
51. 1934-1980 Monitor
52. 1936-1980 Grand Falls Advertiser
53. 1938-1941 Barrelman
54. 1940-1941 Newfoundland Times
55. 1943-1971 Newfoundland Bulletin
56. 1945-1952 Twillingate Sun & Northern Weekly Advertiser
57. 1946-1955 Sunday Herald
58. 1948 Independent & Confederate
59. 1950-1954 Atlantic Guardian
60. 1951-1981 MUSE
61. 1955-1980 Newfoundland Gazette
62. 1956-1957 Newfoundland Weekly
63. 1958-1980 Gander Beacon
64. 1959-1980 Newfoundland Churchman
65. 1960-1961 Examiner
66. 1964-1980 Decks Awash
67. 1964-1980 Diocesan Review
68. 1964-1966 Labrador News
69. 1968-1981 MUN Gazette
70. 1972-1980 Kinatuinamot Illengajuk
71. 1978-1979 Village Voice

Missing Numbers of Newspapers ScannedRoyal Gazette and Newfoundland Advertiser (1810-1818, 1828-1899)

#146	7 June 1810
#186	14 March 1811 to #217 October 1811
#237	5 March 1812
#275	4 December 1812 to #283 28 January 1813
#298	13 May 1813
#298	9 February 1815
#396	30 March 1815
#438	18 January 1816 to #445 9 July 1816
#458	8 October 1816
#464	10 November 1816
#471	7 January 1817
#537	14 April 1818 through 1827 missing from Memorial University Collection - being searching in Provincial Archives
<hr/>	
# ?	10 and 17 June 1828
# ?	1 July 1828
# ?	15 July 1828
# ?	29 July 1828
# ?	24 March 1829
# ?	21 July 1829
# ?	11 August 1829
#1167	5 January 1830
#1179	13 March 1830
#1188	1 June 1830
#1195	20 July 1830
# ?	7 December 1835 to #1501 25 October 1836
#1842*	7 March 1837
# ?	27 February 1840
# ?	2 June 1840
# ?	27 July 1841
# ?	20 December 1842
# ?	22 August 1843
# ?	5 May 1846
# ?	26 May 1846
# 6**	vol. 88 6 February 1895 to #14 vol. 8 2 April 1895
#19	vol. 88 19 November 1895
#11	vol. 90 16 March 1897

* apparent change in numbering system, reversed in 1839

** revised numbering system

Newfoundlander (1830-34; 1837-39)*

#156 15 July 1830
#181 6 January 1831 to #183 20 January 1831
#187 17 February 1831 to #188 24 February 1831
#219 29 September 1831
#280 15 December 1831
#245 29 March 1832
#265 16 August 1832
#275 25 October 1832
#285 3 January 1833
#310 27 June 1833
#331 21 November 1833 to #332 28 November 1833
#342 13 February 1834 to #343 21 February 1834
#352 24 April 1834
#356 22 May 1834
#380 6 November 1834

*All numbers for 1835 and 1836 missing

Public Ledger (1827-38; 1850-59; 1870-76)

#716 4 January 1830 to #717 8 January 1830
#730 23 February 1830
#733 5 March 1830
#744 12 April 1830
#762 15 June 1830
#766 29 June 1830
#768 7 July 1830
#772 20 July 1830
#815 17 December 1830
#817 24 December 1830 to #821 7 January 1831
#842 22 March 1831
#845 1 April 1831
#854 3 May 1831
#883 12 August 1831
#885 19 August 1831
#898 4 October 1831
#929 20 January 1832 to #930 24 January 1832
#932 31 January 1832

Public Ledger (con't)

#940 27 February 1832
#973 22 June 1832 to #974 26 June 1832
#990 21 August 1832
#1042 19 February 1833
#1048 12 March 1833 to #1049 15 March 1833
#1051 22 March 1833
#1062 30 April 1833
#1086 2 August 1833
#1092 13 September 1833
#1102 19 November 1833
#1107 6 December 1833
#1109 13 December 1833
#1117 10 January 1834
#1153 16 May 1834
#1198 21 October 1834
#1200 28 October 1834
#1203 8 November 1834
#1210 1 December 1834
#1214 16 December 1834
#1218 30 December 1834 to #1220 6 January 1835
#1222 13 January 1835
#1226 27 January 1835
#1228 6 February 1835 to #1229 6 February 1835
#1232 17 February 1835 to #1233 20 February 1835
#1237 10 March 1835
#1241 20 March 1835
#1329 8 January 1836
#1335 29 January 1836
#1419 18 November 1836
#1497 25 August 1837
#1525 1 December 1837

#2239 6 April 1852 (1839-1849 not searched)
#2241 ? 25 May 1852
#2263 29 June 1852
#2273 4 August 1852
#2276 20 August 1852
#2288 24 September 1852

? I question the correctness of this number

Public Ledger (con't)

#2290 1 October 1852
#2295 19 October 1852
#2306 26 November 1852
#2313 21 December 1852
#2895 28 May 1858

#1* 4 January 1870 (1860-1869 not searched)
#3 11 January 1870
#43 28 June 1870
#8 27 January 1871
#32 26 May 1871
#34 20 June 1871
#70 30 November 1872
#22 7 June 1873
#44 21 November 1873
#7 24 February 1874
#33** 4 June 1874 to ? January 1875

Evening Telegram (1880-1900; 1910-14)

#? 16 January 1880
2 April 1880
17 April 1880
24 April 1880
5 May 1880
6 May 1880
11 May 1880
28 May 1880
31 August 1880
11 October 1880
22 October 1880
13 November 1880
2 December 1880
7 December 1880

* numbering system through each year employed

** probable that publication suspended during this period according to the succeeding numbering system.

Evening Telegram (con't)

29-31 December 1880

31 March to 19 April 1881

11 May to 14 May 1881

2-3 August 1881

30-31 December 1881

13 February 1883

22 December 1883

APPENDIX IV

REPORTS OF OTHER CANADIAN EARTHQUAKES

Royal Gazette and Newfoundland Advertiser, 12 November 1833

"Earthquake in Canada

The last Minerva contains a strange account of an earthquake, which is said to have occurred at St. Leon, in the district of Three Rivers, which, if true, is well worthy of attention and public notice. About five in the morning a general convulsion was felt throughout an extent of about fifteen acres at the least. It is said to be impossible to describe the scene of desolation which that place now presents; all is overthrown and fallen to the banks of the river.

"The house and barn of Isaac Lesage have sank in, as also the house and barn of Augustin Ferron. Isaac Lesage is now dead, from having been crushed under the ruins of his house. His wife, who had gone out to milk the cows, saw the house sinking in. An old man saved himself, with several children, by getting out by the roof. The body of Lesage has been found, all dreadfully mangled. The house has so sunk into the earth, that nothing but the head of the chimney is visible. The barn has entirely disappeared. The family of Lesage, who have also lost all their provisions and most of their property, are in great privation. It is said that a large cross erected on the road side, as is customary, through the devotion of the inhabitants, was conveyed to a great distance without falling and is now more perpendicular than it was before. The whole of the accident occurred within a short distance of the Church of St. Leon. Montreal Gazette" [Note added by J. Adams - this was a landslide and not an earthquake.]

Royal Gazette and Newfoundland Advertiser, 21 March 1848

"Earthquake in Nova Scotia

A slight shock of this wonderful natural phenomenon was felt on Tuesday morning, between the hours of eight and nine o'clock. From the information we have already obtained, we learn that the shock was experienced in some of the houses situated in the Northern part of the city, in the vicinity of Piera' Mill, and also at Porter's Lake and Lawrencetown it was the most sensibly felt at the two latter places. -Chronicle"

APPENDIX V

Transcription of Historical Accounts

1755 November 1

Tocque, Rev. Philip, 1878. Newfoundland: As it was, and as it is in 1877.
J.B. Magurn, Toronto, p. 145.

"At the time of the great earthquake at Lisbon, in 1755, the effects were felt at Bonavista.

The sea retired and left the head of the harbour dry for the space of ten minutes, when it again flowed in and rose to an unusual height, overflowing several meadows, for about the same space of time as it had retired, and the waters on each side of the Cape were greatly agitated."

1775

Gregory, J.W., 1931. "The earthquake off the Newfoundland Banks of 18 November 1929", Geographical Journal Vol. 77 (2), p. 123-139.

"That some of the earthquakes along this belt started under the Atlantic is well established. The earthquake in 1774, which caused a death roll (sic) of over three hundred in the Burin Peninsula of southern Newfoundland, may have had its origin in earlier movement of the Cabot Trench."

Hodgson, E.A., 1937. Earthquakes in Eastern Canada and adjacent areas, Proceedings of the Royal Canadian Institute, Ser 3A, 2, 30-35.

"The (1929) earthquake stimulated investigation of early records. It was found that, in 1774, there was a tidal wave in the lower Gulf resulting in 300 deaths. This was very likely caused by an earthquake. The first north Atlantic cable was ruptured shortly after it was laid in 1856. The cause of this may have been an earthquake, but it is more likely to have been due to some other strain. Cable breaks occurred in 1863 and in 1890, but there is no record to show that these were caused by earthquakes."

Colonial Office 194 v. 32, ff 78-79.

"Portsmouth, 14th November 1755.

My Lord, . . . I am sorry to inform your Lordship, that these Fisheries, as well as the Trade of the Island of Newfoundland, in the Month of September last, received a very severe stroke from the violence of a Storm of Wind, which almost swept away everything before it; a considerable number of Boats, with their crews, have been totally lost, several vessels wrecked on the Shores, and a number of those lying in the Harbours were forced from their Anchors and sustained much damage. The Fishing works in those places mostly exposed, were in a great measure defaced, and the Waters, which then rose to a height scarcely ever know before, committed great Devastation. Two of His Majesty's armed Schooners belonging to the Squadron under my Command, one of which was stationed at that time on the Banks, and the other on the North-East Coast of Newfoundland, were unfortunately wrecked, but happily by this

accident, only two persons belonging to the Crews of these vessels have been lost. I cannot give your Lordship a very correct estimate of the Damages sustained by this Storm; but should imagine from the different accounts given me that the amount of it in Shipping, Boats, Fishing Works, etc., cannot be less than Thirty Thousand pounds, and the number of people which perished not under Three Hundred "

1809 January 21

Gosling, W.G., 1910. Labrador: Its discovery, exploration, and development, Alston Rivers, Ltd., London.

"On January 21st, 1809, and for some days after, severe shocks of earthquake were felt, and were said to have been general all down the coast. The extra-ordinarily rapid rise of the land, amounting in some places to ten or fifteen feet within the memory of fishermen still going to the Labrador, would lead one to suppose that earthquakes were of common occurrence. No damage or noticeable disturbance has ever been recorded, however." [Footnote in original: "It is stated by a man who has been fishing at Holton Harbour for thirty or forty years, that the spot where he used to moor his vessel is now out of water."] p. 285-86.

Gosling (cont.)

"On November 30th, 1836, a smart shock of an earthquake was felt at Hopedale, attended by a sudden and unusual warmth of temperature". p. 295. (See below, 1836.)

"Earthquake shocks were again noted at Hebron in 1857". p. 300. (See below, 1857.)

Periodical Accounts Relating to the Missions of the Church of the United Brethren, Established Among the Heathen, Volume IV. Brethren's Society for the furtherance of the gospel among the heathen, London, 1806. p. 449 ff.

"From Nain, August 12, 1809. January 21, 1809, and for some days after, we perceived some shocks of earthquakes, which seemed to be felt, as far as we could learn, all down the coast."

1836 November 30

Periodical Accounts Relating to the Missions of the Church of the United Brethren, Established Among the Heathen, Volume XIV. Brethren's Society, London, 1836. p. 209 ff.

"Letters received by The Brethren's Society for the Furtherance of the Gospel, from the Missionaries on the coast of Labrador, in the Year 1837.

Hopedale, July 27th, 1837. Dear Brethren, ... On the 30th of that month [November], we experienced a smart shock of an earthquake, which lasted several seconds." [Footnote in original: "The following additional particulars respecting these phenomena are derived chiefly from the private

correspondence of the Missionaries. The earthquake appears to have been felt only at the two southern settlements of Nain and Hopedale, and to have been accompanied with a subterranean rumbling noise, resembling thunder. The vibration, which lasted several seconds, appeared, to the Missionaries at Nain, to be in a direction from N. to S. The Esquimaux, who felt the shock at the outplaces where they were staying, thought it had a motion from W. to E. They also reported, that it was attended with sudden and very unusual warmth in the atmosphere."]

1837 (circa), winter

Tocque, Rev. Philip, 1878. Newfoundland: As it was, and as it is in 1877.
J.B. Magurn, Toronto, p. 144 - 145.

About forty years ago, in the winter season, a very singular and most extraordinary sound was heard in the neighbourhood of Bonavista. It commenced about three o'clock in the afternoon and lasted until the next day about noon. The men at Bird Island Cove were going about nearly all night, some with loaded guns, some with hatchets, and others with whatever weapon they could command. The sound is described as resembling distant thunder. It has also been compared to the growl of a bear, the bellowing of a cow, etc., conveying a deep sepulchral tone. What is most strange and unaccountable is that it appeared alongside of everybody, although at the time some were at a distance from each other of from one to five miles. Men hauling wood at the time thought the sound came out of the ground immediately under the slide or team, and, in some instances, were so alarmed as to leave the wood behind. Several females thought a bear had got into their chambers and ran terrified from their dwellings.

This singular sound could not have originated from the rumbling noise made by the ice, because no ice, at the time, was near the coast - neither would the noise made by the ice be heard in the peculiar manner this sound was heard; and it does not appear to have been symptoms of an earthquake, because no trembling nor the slightest motion was felt in the earth; and nothing remarkable occurred immediately after the sound passed away, excepting that two days afterwards one of the heaviest ground-seas ever known took place..... This sound is termed by the inhabitants of Bonavista and Bird Island Cove, the "thunder-growl".

1857 January 12

Periodical Accounts Relating to the Missions of the Church of the United Brethren, Established Among the Heathen, Volume XXII. Brethren's Society, London, 1856, pp. 323 ff.

"Hebron, August 20th, 1857. Dear Brethren, On the 12th of January, a smart shock of an earthquake took place, which caused the Esquimaux to run in alarm out of their huts."

1864 June 27, 19h local time

Telegraph. St. John's, Newfoundland, 13 July 1864.

"On Monday, the 27th ulto., at 7 o'clock, P.M. the sea in St. Shott's receded for 250 yards beyond where the wreck of H.M.S. LITTLE DRAKE lies submerged in 5 fathoms water; in about 10 or 12 minutes it returned with fearful velocity bringing large stones gravel, &c., with it, filling up the Gut at St. Shott's; overturning several boats and sinking one. The wreck of the Little Drake was distinctly discernable; the shot, bolts, and guns seen. No doubt a severe submarine volcanic eruption has taken place in some place not very remote from our Southern Shore."

Public Ledger. St. John's, 15 July 1864. (Cites Telegraph as source.)

"On Monday, the 28th ulto., at 7 o'clock, p.m. the sea in St. Shott's receded for 250 yards beyond where the wreck of H.M.S. Little Drake lies submerged in 5 fathoms water; in about 10 or 12 minutes it returned with fearful velocity bringing large stones, gravel, &c., with it filling up the gut at St. Shott's overturning several boats and sinking one. The wreck of the Little Drake was distinctly discernable; the shot bolts, and guns seen. No doubt a severe submarine volcanic eruption has taken place in some place not very remote from our Southern shore."

Devine, P., and O'Mara, 1900. Notable events in the History of Newfoundland.

"At 7 p.m. the sea at St. Shotts receded 250 yards beyond where the wreck of H.M.S. Drake lies submerged in about five fathoms of water. In about ten or twelve minutes the water returned with fearful velocity, bringing large stones and gravel, and filling up the gut at St. Shotts. The wreck of the Drake was distinctly discernable, the shotbolts and guns seen. June 18, 1864."

Smith, W.E.T., 1962. Earthquakes of Eastern Canada and adjacent areas 1534 - 1927. Publications of the Dominion Observatory, Vol. 26 (5), Ottawa, Canada. p. 279.

"1864, July 28. 7:00 p.m. [intensity] V. 46°5N, 53°7W. Off the coast of Newfoundland. The shock caused a "tidal wave" at St. Shotts Harbour, Nfld. Reported in a letter from a resident of Newfoundland."

1884 March 18, 13:15 local time

Dawson, W.J., 1894. "Our record of Canadian Earthquakes", The Canadian Record of Science, Vol. VI. (1894-1895), p. 15.

"Statement of earthquake shocks felt in Canada: March 18, 1884. St. John, Nfld., Trinity Bay, Harbor Grace, Heart's Content, Bay Robert and Holywood (sic) at 1.30 to 1.45 p.m., movement north to south."

Evening Telegram, St. John's Newfoundland, 19 March 1884.

"Yesterday's Earthquake. Slight Shocks at Harbor Grace and Several Other Places. Late telegraphic advices confirm the report in circulation here this morning regarding "an earthquake in Conception Bay". It seems that between 1 and 2 o'clock p.m. yesterday slight shocks were felt at Harbor Grace, Carbonear, Holyrood, Placentia, Trinity and Black River. In some cases the oscillations were quite perceptible, and not a little alarm was felt. It does not appear, however, that any damage has been sustained anywhere in consequence. We shall, doubtless, have further particulars later on."

Terra Nova Advocate and Political Observer, St. John's, Newfoundland, 20 March 1884.

"Yesterday morning we received intelligence that several shocks of earthquake had been experienced the previous afternoon, at various points in the districts of Conception and Trinity Bays, notably in the vicinity of Harbor Grace Junction, at Harbor Grace, Carbonear, and Hearts Content. We anxiously await further particulars of a phenomenon of such rare occurrence in this colony."

Newfoundlander, St. John's, Newfoundland, 21 March 1884.

"An Earthquake Shock. Bruigus (sic), March 19. Considerable excitement prevailed yesterday afternoon in Conception Bay and surrounding districts, in consequence of an extensive earthquake shock being felt. About one p.m. a report like that of a tremendous blast was heard simultaneously at Brigus, Harbor Grace Junction, Bay Roberts, Harbor Grace, Black River, Placentia Bay and at Trinity. A rumbling noise followed for the space of thirty seconds. Some houses at Heart's Content were shaken. A woodman crossing a pond nine miles west of this village felt the ice tremble, and his horse took fright. At Clarke's Beach the earth trembled, and people ran to each other's houses. Patrick Dooley and Aubrey Spracklin were boiling their kettle at the foot of a hill near Grand Pond, and report themselves badly scared at the time. They beat a hasty retreat, fearing the hill would fall on them. They say it was shaken from base to top."

Standard and Conception Bay Advertiser, Harbour Grace, Newfoundland, 22 March 1884.

"Remarkable Phenomenon -- At 1.15 p.m. on Tuesday last, many of our citizens were startled by hearing a heavy report issuing from the heavens apparently in a S.W. direction. The report sounded as loud as that occasioned by a heavy discharge of cannon, and was followed by a succession of rumbles or angry and prolonged detonations, which lasted four minutes or nearly so. The noise was heard even more distinctly at Heart's Content, where, we learn, it had the effect of drawing many persons in alarm from their houses. At Trinity, Spaniards Bay, Bay Roberts, Brigus, Clarke's Beach, Holyrood, Black River, Placentia Bay, St. John's, and other places the report was also heard with more or less distinctness. A despatch from Brigus in Wednesday's Mercury says that "a woodman crossing a pond nine miles west of that place felt the ice tremble, and his horse took fright. At Clarke's Beach the earth trembled, and people ran to each others' houses. Patrick Dooley and Aubrey Spracklin were boiling their kettle at the foot of a hill near Grand Pond, and report

themselves badly scared at the time. They beat a hasty retreat, fearing the hill would fall on them. They say it was shaken from base to top." Many theories were, of course, advanced to account for the apparently mysterious occurrence, some people suggesting one thing, some another. The opinion, however, which obtained the most weight was that it was a gaseous meteor which had exploded as it reached our atmosphere."

Evening Telegram, St. John's, Newfoundland, 22 March 1884.

"From Hearts Content. The Earthquake of Tuesday Last, Sir.-- The phenomenon which visited the peninsula of Avalon yesterday has given rise to various conjectures as to its origin. Before those who heard the noise had given much thought to the matter, earthquake was assigned, but since it has been generally supposed that, as meteors of great explosive power frequently fall in warm corners of the globe, the explosion of yesterday was caused by one falling in the neighborhood of Harbor Grace junction, where the navvies have been making it so hot lately. One sarcastic gentleman ascribes it to the Government being "on the bust." The explosion, as people here felt it, was similar to the report of a heavy blasting charge, and seemed so near that many persons looked out of the windows of their houses to see if an accident had occurred. There was not much alarm created, call it what you will--earthquake, volcano, or meteor. The events of St. Stephen's day have left impressions on the minds of a certain section of the population of a more serious nature, and which are not to be written about lightly; for they concern the welfare of the whole community. I allude to the uneasy feeling of the minority in settlements where party prejudice runs high."

Terra Nova Advocate and Political Observer, St. John's, Newfoundland, 22 March 1884.

"In connection with the late shocks of earthquake in our vicinity, we are informed that parties of excursionists at Fanny's Pond and other suburban localities had experience of the same."

Terra Nova Advocate and Political Observer, St. John's, Newfoundland, 25 March 1884.

"Some of our local scientists have been puzzled to account for the explosive disturbance popularly rumored to be the consequence of an earthquake which occurred on the 18th inst. The difficulty becomes more puzzling, as it is said that a similar noise was heard in the vicinity of the Railway Office on Saturday evening last, supposed to be the result of the perusal by Mr. Hobbs, of the article in last Saturday's "Telegram." At any rate, that gentleman was seen to enter the establishment in Gregory's Lane, yesterday morning in anything but an amiable mood. It was noticed that the atmosphere in that vicinity last evening gave marked indications of more moderate weather in future."

1884 October 04

Milne, J., 1897. "Sub-Oceanic Changes". The Geographical Journal, Vol. X, p. 129-146 and p. 259-289.

North Atlantic. Through the kindness of an engineer, whose experience in the laying and repairing of cables has extended over many years, I am enabled to give the dates at which various cables have become ruptured, or been restored to working order. The only case of alteration in depth which he noticed was during the repairs of November, 1884, but this was not great. It seemed as if the picked-up cable had to be pulled from under a bank of earth which had slipped down from the eastern slope of the Newfoundland bank.

The following is a table of North Atlantic cable-interruptions.

North-eastern Slope of Flemish Cap.--(37° W to 44° W long.) July, 1894 (about); June, 1888 (about); September, 1889; September, 1881; June 10, 1894; July 28, 4:40 a.m., 1885; April 18, 8 p.m., 1885; July 25, 8 a.m., 1887; June, 1895.

Near South-eastern Slope of the Newfoundland Bank.--(46° W and 50° W long.) September, 1887 (about); October 3, 9:15 p.m., 1884; October 4, 4.8 (Sic) a.m., 1884; October 4, 4 and 8 a.m., 1884; September, 1889.

A striking feature connected with these Atlantic troubles is that nearly all have occurred in deep water near to the base of the eastern slope of the Flemish Cap, 330 miles from St. John's, Newfoundland, or the south-eastern slope of the Newfoundland bank...

In one case only has the cause of failure been attributed to a landslide, which it is just possible was caused by, or accompanied with seismic phenomena. A very significant fact is the case when three cables running in parallel lines about 10 miles apart, broke at points nearly opposite to each other, on the same straight line. This was on October 4, 1884. At first the accidents were attributed to the grapple of a cable vessel, but as no grappling was done then, this hypothesis had to be abandoned. Because three cables broke apparently at the same time in the same locality, one inference is, that the cause resulting in rupture was common to all, and this may have been a sudden change in the configuration of the ocean bed.

1890

Devine, P., and O'Mara, 1900. Notable Events in the Story of Newfoundland. St. John's, Newfoundland, p. 139.

"July 23rd: Two shocks of earthquake felt at the Block-house by signal man, M. Cantwell, at 7 o'clock this morning, 1890." [No supporting newspaper evidence.]

1907 January

Evening Telegram, St. John's, Newfoundland, 20 January 1907.

"Tidal Wave at Old Perlican.

The big tidal wave, which recently swept our coast, caused much damage at Old Perlican. The tide rose to an abnormal height, completely submerging all the stages and flooding the stores along the water front. Almost all the stages were washed away or otherwise damaged before any preparations to save them was feasible. To prevent the stores from meeting a like fate ropes and hawsers were fastened around them, the ends of which were tied to rocks. A quantity of salt and other fishing requisites were more or less destroyed."

1909 December 20

Evening Telegram, St. John's, Newfoundland, 22 December 1909.

"Stages Swept Away. People who arrived here by the shore train last night from the North Shore say that a very high sea has been running all along the shore since Sunday last and in several places a number of flakes and stages have been swept away. At Lower Island Cove most of the stages were demolished by the sea, and Geo. Fagner and Joseph Sparks lost a lot of fish which was under salt in their stages. At Kettle Cove Monday several boats were swept from the collars on which they were moored and broken to pieces."

"S.S. Kamjford Here.

The S.S. Kamjford arrived here yesterday from Sydney after a boisterous passage. She left Sydney on Saturday morning, and night and day had stormy weather, seas swept the decks and the ship was unable to make much headway till Monday."

1924 March, 1925

Daily News, St. John's, Newfoundland, 27 November 1929.

"Felt One in 1924. Though this recent tremor is thought by some to have been the first recorded in the country, it is not the first which has been experienced. Dr. L. M. Green, of this town [Deer Lake], tells of a similar incident which occurred at Lomond, he believes in March 1924. The doctor was paying an evening visit to Mr. Simpson superintendent of the St. Lawrence, Pulp, Timber and S. S. Co., there, and both were deep in some conversation when a sudden vibration caused them to stop and listen attentively. Mr. Simpson who had lived in volcano regions and experienced several previous shocks, felt sure it was a tremor and pointed it out to the doctor. The vibration becoming increasingly noticeable for a minute or more, left them without any doubt as to what was happening.

"Tidal Wave in 1925. He also reports a tidal wave of considerable velocity which struck a section of Bonne Bay in 1925, he thought, causing families to leave their homes. It was absolutely instantaneous and without any previous disturbance, and one family barely escaped before their house was submerged. These stories are authentic and are worthy of mention now. It might be noted that these occurrences were related by Dr. Green in the presence of the writer many months before the recent tremor caused the prevailing excitement around the country."

1940 April 11, 01:10 local time

Evening Telegram, St. John's, Newfoundland, 12 April 1940.

"Severe Earth Tremors Felt on South West Coast Yesterday.

People Startled from Sleep by Shocks Lasting Three Minutes.

About a.m. [??] yesterday, residents in places along the South-west coast were startled from their sleep by severe earth tremors. The shocks continued for several minutes and caused considerable alarm. Although the tremors are said to have been as severe as those experienced at the end of November, 1929, in the Burin area, no damage appears to have occurred.

The first message relating the occurrence was received by The Telegram from Placentia, too late to appear in yesterday's issue. It read:

"Exclusive to The Telegram: Severe earth tremor felt Rencontre West and Francois 1.10 a.m. The entire communities were aroused by the noise. No damage was done although the shocks were equal to those of 1929."

The following messages were received by Gerald S. Doyle, Ltd., through whose courtesy they are published:

BURGEO, April 11: Half a dozen short rumblings heard about 1.30 this morning were thought to be purely local until Ramea, Cape La Hune and other places along the coast experienced the same noises at the same hour. It is thought this might be a slight earth tremor. In some places residents state it was louder than the tremors of 1929.

FRANCOIS, April 11: About 1 a.m. to-day a heavy shock occurred lasting about two minutes. Houses were heavily shaken. No damage resulted. During the shock flashes of flames were seen in the sky by several people.

RENCONTRÉ WEST, April 11: A several earth tremor or some other disturbance was heard here at 1.10 this morning lasting about two or three minutes. No one was up at the time and the whole community was aroused by the noise and some stayed up for the remainder of the night. It was also heard severely at New Harbour and other nearby settlements. No damage was reported but the shock equals that of 1929.

"SOUTH COAST DISASTER

The earthquake and tidal wave previously experienced in the Burin Peninsula and felt throughout a great part of the island occurred on the evening of November 18th, 1929. While the Burin area suffered most severely, destruction extended over a considerable stretch of coastline. Thirty seven persons lost their lives and property damage was placed at \$400,000. No less than forty towns and villages affecting 10,000 people, suffered in the disaster. Between November and May of the next year over \$256,000 was subscribed in the relief fund, of which \$189,500 came from the people of Newfoundland."

1956 January 5, 11:20 local time

Evening Telegram, St. John's, Newfoundland, 6 January 1956.

"Tremor Rattles Dishes. A mild earth tremor which affected only the Bay de Verde Peninsula between Conception and Trinity Bays, was felt (and heard) at 11.20 a.m. Wednesday. It lasted for about a minute and a half, did no damage.

Since there are no instruments for recording earth quakes in Newfoundland, the center of the shock canont (sic) be pinned down exactly, but reports from towns north to Grates Cove and south to Shearstown, would indicate that the centre must have been very close to latitude 48:0:0, either under the peninsula, or very close to shore under one of the bays.

The tremor was accompanied by a "rumbling like thunder" coming from the depths of the earth, and reminded some witnesses of the earthquake of 1929, though it was of a much milder nature. People felt the ground tremble beneath them, those indoors heard windows rattle, and dishes jump on the shelves. Stoves and tables trembled.

The last earth tremor in Newfoundland was on April 11, 1940, when the southwest coast was affected in the region of Rencontre East, Burgeo and Francois.

Yesterday's vest pocket-sized earthquake was the second since the tragic quake and tidal wave which inundated sections of Newfoundland's south coast in 1929."

Western Star, St. John's, Newfoundland, 6 January 1956.

"One Minute Shock Is Felt Throughout Conception Bay. ST. JOHN'S, Nfld. (CP) -- A mild earth tremor accompanied by a "rumbling like thunder" was reported yesterday by residents of villages along the shores of Conception bay and Trinity bay on the east coast.

Memorial University and weather office spokesman said they knew of no seismographs or other instruments in Newfoundland that might have recorded the shock.

The seismograph at Dalhousie University in Halifax is read at 9 a.m. AST daily.

The tremor appeared to be localized in an area 75 to 100 miles from St. John's.

A Harbor Grace man who telephoned word of the miniature earthquake to St. John's said he felt the ground tremble beneath him while a growling noise like the rumbling of thunder seemed to come from the depths. The tremor was not serious enough to do any damage or cause any injuries.

The shock was felt at 11.20 a.m. It lasted for about 1 1/2 minutes, most witnesses said. An early theory that the tremor may have been caused by an explosion in a power generating plant was discounted.

Reports of the tremor were received in St. John's from Carbonear, Harbor Grace, Heart's Content, Western Bay, New Perlican and Old Perlican. Because of the lack of recording instruments the area of severest shock could not be pinned down.

While the rumbling continued dishes rattled on shelves and stoves and tables trembled, according to some reports.

One witness said it sounded as if a truck had been driven through a fence. A mother said it resembled the trembling and noise that preceded a tidal wave which caused disaster on the south coast following an earthquake in 1929, but was not so severe or loud."

1957 January 26

Evening Telegram, St. John's, Newfoundland, 4 February 1957.

"Coast Steam Blow Underground Stream

It wasn't a volcano . . . as the people of the south coast settlement of Franchois (SIC) had figured. Instead, the steam that was rising from a mountain near the town was caused by an underground stream.

Dr. David Baird, government geologist, flew to Franchois Saturday to examine the phenomena. He said there was nothing to be alarmed about. There was a stream 'flowing inside the cliff at a 45 degree temperature all year.

This has been the coldest winter in years with temperatures near zero last week. When the warm, damp air from the stream passed up the slope and out through a hold (sic), it hit the outside air and caused steam."

1957 January 26, am local time

Daily News, St. John's, Newfoundland, 28 January 1957

"Earth Tremor At Grates Cove

Loud rumblings accompanied by earth tremors were felt at Grates Cove on Saturday morning. A telephone check in the area confirmed this report but news from other communities in the area told of no disturbance in other communities on the Peninsula. One man described the rumblings as "louder than those he heard during the tidal wave of 1929 on the South West Coast".

1965 November 15, 11:12 GMT

Evening Telegram, St. John's, Newfoundland, 16 November 1965.

"Minor tremor at Bonavista. A mild earth tremor yesterday shook parts of the northern Bonavista Peninsula, vibrating houses and rattling dishes.

Dr. E. R. Deutsch, physics professor at Memorial University, said that the tremor was recorded on a seismograph at the university.

Dr. Deutsch said the tremor occurred at about 8 a.m. and lasted 50 seconds.

Mrs. Mark Johnson of Little Catalina, about 5 miles from Bonavista, said she jumped from her bed when she felt it tremble. Other residents of the area reported the vibrating of houses and rattling of dishes.

No damage was reported."

Gander Beacon, Gander, Newfoundland, 17 November 1965.

"Earth tremor in Bonavista area. A small earth tremor was experienced in Newfoundland on Monday in the Bonavista area. The RCMP at Bonavista said at noon that it was experienced at 7:40 a.m. and lasted for just three or four seconds. The tremor was felt in Bonavista, Catalina and Port Union. No damage or injuries were reported.

1969 February 02, 04:24 GMT

Evening Telegram, St. John's, Newfoundland, 3 February 1969.

"Slight quake hits province. A slight tremor in the interior of Newfoundland was recorded about 1 a.m. Sunday morning by the seismograph at Memorial University. The tremor was not considered big.

Dr. E.R. Deutsch, associate professor of physics, said the exact magnitude and location could not be determined because the seismograph in St. John's was too close to it. He said tremors that occur more than 1,000 miles away are much easier to pinpoint and the centre of this one will have to be identified by readings from other seismograph stations in Canada.

Reports of wells collapsing and basement walls cracking in the Lewisporte area were not confirmed by either the town council or the RCMP.

Town clerk G. Francis said several reports were received from the area about a noise and a shaking of the ground. The noise, which was heard in the Grand Falls-Windsor area and as far north as LaScie, seemed to be centered in Notre Dame Bay, he said.

Numerous minor tremors have been felt in the province, but only the quake of 1929 caused any deaths."

HISTORICAL SEISMICITY OF NEWFOUNDLAND

PART II: SUMMARY OF EARTHQUAKE HISTORY AND
ASSESSMENT OF NEW EVENTS

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April 1985

INTRODUCTION

The contracted study of the historical seismicity of Newfoundland was initiated to improve the Earth Physics Branch's knowledge of seismicity along Canada's eastern continental margin. While only a few minor earthquakes were known from the island itself, earthquakes offshore, that might have been felt in Newfoundland, are relatively common. Figure 4 is modified from Basham and Adams (1982) and shows the earthquakes (in the period 1909-1979) known at the start of the contract.

The current contract is the first of a series that will investigate seismicity in the Atlantic Provinces and along the eastern offshore margin. Other work in progress includes: a study of the historical seismicity of northern New Brunswick, a study of the instrumental seismicity at the mouth of the Laurentian Channel, and a study relocating all other offshore earthquakes south of 55°N. Future contracts to investigate historical earthquakes in southern New Brunswick and in Nova Scotia are also possible.

Figure 5 is a map of the island of Newfoundland showing localities, revised earthquake epicentres, and ellipses representing approximate felt area, for each confirmed earthquake discussed below.

ASSESSMENT OF EVENTS DISCUSSED IN PART I

1755 November

The great earthquake at Lisbon on November 1, 1755 caused a devastating tsunami. A tsunami was also recorded in November 1755 at St Martins Harbour in the West Indies where vessels were left aground (Smith, 1962, p. 290). Smith's attribution of the West Indies tsunami to the November 18, 1755 Cape Ann, Massachusetts, earthquake that happened two weeks later represents a mistake in the source cited by Smith.

Anne Stevens, Earth Physics Branch (private communication, August 1984), has analyzed the event as follows: W.T. Brigham reported that the tsunami in the West Indies occurred nine hours after the shock was felt in Boston, that is about 2 p.m. The average velocity of this alleged tsunami would have been about 300 km/hr, well below the typical velocity in the open ocean. If, however, the tsunami in the West Indies occurred about 2 p.m. local time on the day of the earthquake felt in Lisbon about 10 a.m. local time, the average velocity (allowing for the difference in time zones) would be 700 km/hr, a more typical value. Further, a comprehensive compilation of the local effects of the Cape Ann earthquake (Street and Lacroix, 1979) makes no mention of a tsunami either locally or at larger distances. Thus it can be concluded that the Cape Ann earthquake did not produce a tsunami in the West Indies or elsewhere.

The event in Bonavista Bay is therefore considered a reliable record of the Lisbon tsunami. Bonavista is closer to the probable source of the tsunami than St. Martins, and from the description, the amplitude of the tsunami at Bonavista was likely a few metres, comparable to that at St Martins.

1775

Gregory's source of information is not certain. Hodgson's account was a general summary of eastern Canadian seismicity and apparently cited Gregory. A news item that could have given rise to Gregory's comments was carried by the Halifax Herald on November 22, 1929 and was found subsequent to completion of Staveley's contract:

"TIDAL WAVE IS NOT THE FIRST

St. John's, Nfld., Nov. - Monday's tidal wave which took an unknown number of lives, estimated at from twenty-seven to thirty-six, in the Burin peninsula, was not the greatest disaster of its kind to strike Newfoundland. Says Prowse's History: 'The year before the outbreak of the American war was remarkable for a terrific storm at sea which destroyed a vast amount of fishing property. The water rose suddenly twenty feet above its usual level. This great tidal wave caused immense destruction both by land and sea and three hundred persons along our coast lost their lives'". (Note Prowse (1895) has an additional sentence "It is known in the Newfoundland Annals as 'Year of the Great Storm'").

It is clear from the quote that the storm and reference to the tidal wave were misinterpreted by Gregory and then by Hodgson, a view that is supported by the Governor's comments and Staveley's discussion of them.

1809 January 21

This earthquake (together with those in 1836 and 1857) is in Smith's 1962 catalogue, however details of the event are lacking. Smith located this earthquake on the Labrador coast near Nain (57.0°N, 62.0°W) and assigned a felt intensity of Modified Mercalli V (equivalent approximately to a magnitude of 4.4) based on the felt reports in Gosling.

Although modern seismographs have monitored the region along the Labrador coast for small earthquakes, none have occurred onshore or close to the coast (Basham and Adams, 1982) since 1962. Therefore Basham and Adams (1983) presumed that the earthquakes felt in the 1800's were located offshore, possibly along the continental slope, where frequent moderate earthquakes do occur.

That the 1809 event was felt "all down the coast", and that "some shocks" (aftershocks) were felt "for some days after" might suggest that the mainshock was large, possibly magnitude 7 (Basham and Adams, 1983). To our knowledge, the magnitude 5.5 earthquakes that occurred in 1934 and 1971 (see below) were not felt along the Labrador coast; hence the felt aftershocks were probably larger than M 5.5, and the mainshock was larger still. On the other hand the extract from the Moravian reports could be interpreted as recording several earthquakes of similar size.

Although I do not consider the above analysis sufficiently sound to change the CEEF entry at this time, I believe that Smith's location and the 4.4 magnitude calculated from the intensity are clearly in error and suggest that better parameters would be 57°N, 58°W (i.e. offshore from Nain) and magnitude 6.5. The original Moravian mission records need to be examined to determine the felt extent of the earthquake, and whether it was felt most strongly at Nain, in order to confirm that the main earthquake was located offshore.

1836 November 30

Smith considered this a MM V (magnitude ~4.4) earthquake at Hopedale (55.5°N., 60°W). The Moravian records record the earthquake being felt from Hopedale to Nain (125 km), but not at the more northern Moravian settlements. The event was accomplished by a rumbling noise. A minimum magnitude, assuming a felt ellipse 150 km long by 75 km wide and Nuttli and Zollweg's 1974 formula is 3.9.

As no small earthquakes are known to have occurred along the Labrador shore (see 1809 event), I consider it to represent a moderate offshore event, perhaps magnitude 5.5 near 56.5°N, 58°W, although it is still too early to document this formally. (see also 1837 event)

1837 circa, Winter (about 40 years before 1877)

As described by Tocque from Bonavista, this event sounds more like some meteorological phenomenon than an earthquake. Unfortunately, Tocque's source is not given, though Staveley provides good reasons to suspect the report is credible. Staveley also points out the occurrence could correspond to the November 1836 Labrador earthquake (the Bonavista event was in the winter season but pack ice was absent from the coast). However, the absence of ground shaking and the presence of continued sounds (which would not be expected from a distant large earthquake) make this occurrence unlikely to represent an earthquake.

1857 January 12

Smith considered this a MM IV (magnitude ~3.7) earthquake at Hebron (58.2°N, 62.6°W), but I again consider it to represent a moderate offshore event, perhaps magnitude 5.0 near 58°N, 60°W. Gosling's plural: "earthquake shocks" was apparently a misquote from the Moravian records and does not indicate a mainshock/aftershock sequence. The day and month of the event are to be added to the CEEF.

1864 June 27

This event is in Smith's catalogue (Smith, 1962), though with an incorrect date, as is clearly shown by Staveley. It is identified as an intensity V earthquake just offshore of St. Shott's harbour. The assigned location and source mean that (in the absence of other documentation) Smith considered the event to represent a moderate event just offshore. Staveley's research shows that the event is soundly based, and the description, especially the initial withdrawal of the sea, strongly supports its identification as a tsunami.

St. Shott's is on an open coast and not at the head of a large bay such as may have caused the dramatic amplification during the 1929 tsunami on the Burin Peninsula. A five fathom (10 m) sea level change is therefore even less easily understood. There are five possibilities:

- a very local earthquake
- a 1929-sized earthquake at some distance offshore
- a very large mid-Atlantic earthquake
- a local submarine slide
- some undocumented meteorological phenomenon

A very local earthquake (as suggested by Smith) is thought unlikely because there were no reports of ground shaking or of earthquake noise. Likewise, it is highly unlikely the effects of a 1929-sized earthquake could have been overlooked either at St. Shott's or at other places along the Atlantic coast. A search of the tsunami literature has provided no evidence for a distant North Atlantic tsunami at the time, although a search of newspaper and harbour records from Nova Scotia would still be worthwhile.

Although a local submarine slide could provide a plausible cause, none of the earthquake alternatives seem very probable. Whether or not there was an earthquake, Smith's epicentre and magnitude are unreasonable, and therefore until other data or explanations for the event are forthcoming, the values in the CEEF should be regarded as "place-holders" only.

1884 March 18

This is a well-documented record of an earthquake on the Avalon Peninsula. While many of the newspaper reports are derivative, the earlier ones cite many places where the earthquake was reported, though none describe damage or the nature of the shaking fully. Most reports suggest people heard rather than felt the earthquake, but I do not make this distinction in the following analysis. The felt localities are shown on Figure 3a together with an ellipse enclosing the known felt area. It is clear from the reports that the earthquake was felt most strongly between Harbour Grace and Heart's Content, and was felt only mildly at St. John's. Smith's epicentre (47.2°N 53.0°W) is south-southwest of St. John's and, in the view of the felt data in Figure 6a, should be moved 70 km north northwest to 47.8°N 53.3°W, with an associated error of about ±30 km or less.

The felt area (enclosed by the ellipse on Figure 3a) is 21,200 km², which by Nuttli and Zollweg's 1974 formula gives a calculated magnitude of 4.1. The felt reports are noticeably mild with no damage being reported, though many people at Heart's Content and Clarkes Beach were frightened enough to run outdoors. The maximum felt intensity is no higher than MM V, and suggests a maximum magnitude of 4.3 (from $M = 1 + 2I/3$, Smith, 1966). A magnitude of 4.1 is assigned.

The event is to be compared with the earthquake of 1956 in the same area, which was clearly smaller and less widely felt (Figure 3b). The uncertainty in the 1884 and 1956 epicentres is such that they could easily be at the same place.

1884 October 04

It is imprudent to attribute these cable breaks to an earthquake. Circumstantially, the evidence points to a single slump (which might have been earthquake-caused), but no seismographs existed then and nothing is known to have been felt on the nearest land, St. John's. Since 1937, the seismograph network has been sufficiently sensitive to detect magnitude 5 earthquakes offshore, but so far none have been located in the area of the slump in contrast to many earthquakes located on the Laurentian Slope and in the Labrador Sea. Consequently, an earthquake is considered dubious.

1890 July 23

Not an earthquake. Staveley's account is a good example of the reasoning needed to dismiss this type of event. It had not been included in any earthquake catalogue.

1907

Not an earthquake. Shows the importance of weather reports in evaluating reports.

1909 December 20

This earthquake is documented from Cape Breton Island (Smith, 1962). Basham et al. (1982, Appendix C) considered there was little evidence to support Smith's epicentral intensity, and so reduced the magnitude from 5.0 to 4.0. The original published source (McIntosh, 1910) does not support Smith's assertion that the shock was felt throughout Cape Breton Island. The felt localities (Port Hood, Mabou, Inverness, Lake Ainslie, Whycocomagh, and Orangedale) lie within a 25 km radius, and McIntosh specifically states that the earthquake was not reported felt beyond these points. The lack of reports from Newfoundland further suggests that it was a local earthquake on Cape Breton Island and not a large offshore earthquake like the one in 1929 which was felt in both Cape Breton Island and Newfoundland. However, additional confirmation is required from the Cape Breton newspapers before the CEEF epicentre and magnitude are again revised.

1922

This event is known from seismograph records but is poorly located. The present epicentre is taken from the International Seismic Summary. Smith appears to have estimated an epicentral intensity (VI-VII) from which the magnitude of 5.3 was later calculated. The size of the event is poorly known. That it was not reported felt at St. John's supports a location well offshore. As is apparent from the Ottawa station bulletin and the ISS summary, the event occurred at 06h31 and not 07h31 as in the catalogue. This appears to have been an error by Smith (1962) in converting from UT to EST (06h31 is 0231 EDT not 0231 EST). (Note added June 1985: Dr. Rutger Wahlstrom has located and read the Halifax record for this event and reports the phase arrival times to be inconsistent with the present epicentre. A formal revision, which will probably place the earthquake in Baffin Island or in Baffin Bay, will be published later.)

1924 March

This report from "an evening in March, 1924" is probably a felt report of the February 28, 1925 Charlevoix earthquake that occurred at 2119 EST. Smith (1962 p. 303) shows an isoseismal map for the earthquake, which suggests he knew of no felt reports from Newfoundland; however the extent of the isoseismals to the southwest suggests that the earthquake could have been felt in western Newfoundland. All items in the St. John's newspapers originated outside Newfoundland, so that the earthquake is unlikely to have been widely felt in eastern Newfoundland.

1925

This event needs further investigation, but seems unlikely to be an earthquake. The 1925 Charlevoix earthquake did not cause a tsunami, and it is very unlikely that another earthquake of the necessary size (magnitude 5 at least) would have been missed by both the press and the seismographs then operating. The region of western Newfoundland and the Gulf of St. Lawrence is almost totally lacking in earthquakes, so that a moderate-sized, very local earthquake is unlikely. An outside possibility is an earthquake near current seismicity at Anticosti Island, but this is so far away from Bonne Bay that any such tsunamigenic earthquake should have been felt on the north shore of Quebec.

1934

Earthquake in EPB Catalogue. Not felt in Newfoundland.

1940 April 11

Severe earth tremors felt at 1:00 am local time 11 April, at a number of places along the southwest coast from Burgeo to Rencontre West (Figure 5). The reports emphasize the noise of the event, and "flashes of flames in the sky" were reported from Francois.

The possibility that the event was not an earthquake but rather the explosion of a wartime ammunition ship was investigated by contacting the Directorate of History of the Canadian Armed Forces; however, in the standard references there is no record of any ship being lost in the vicinity. German U-boats were not active off Newfoundland at that time and the tracks of the German surface raiders are well known. Furthermore, the earthquake report occurred on a page in the Evening Telegram that was dominated by news of the war in Europe; surely local residents could have made the connection to a sinking ship, were that the case.

Hence, the event defies a simple, non-earthquake explanation and must be considered a probable earthquake.

The event was reported to have been as severe as the 1929 earthquake which in this region was interpreted as MM V - VI (Smith, 1966). For 1940, the maximum felt intensity approximates MM IV - V, and suggests a magnitude of 4 (from $M = 1 + 2I/3$, Smith, 1966).

A minimum estimate for the east-west extent of the felt area is 90 km, and assuming this to be the major axis of an ellipse with a 2:1 axial ratio, the felt area is 3100 km² (Figure 5). Applying the formulation of Nuttli and Zollweg (1974) gives a calculated magnitude of at least 3.6. Therefore a magnitude of 3.6 is assigned.

Seismograms from Halifax and Seven Falls were examined as set out in Table 3. Both the records were quiet, and no indication of seismic signal was seen. Interpretation of the quiet trace on the HAL Bosch (which had poor short period response) is difficult, but judging from the trace from a magnitude 5 aftershock of the 1929 Grand Banks Earthquake recorded on the HAL

Mainka, it would be surprising if the 1940 event was larger than 5.0. Seven Falls provides an upper limit on the size of the earthquake of $M=4.5$ (calculated using the $m_b(Lg)$ relation of Nuttli).

The record of felt earthquakes from the Laurentian Slope seismic zone, the main region of high seismicity nearby, makes it highly improbable that a magnitude 4.5 or smaller earthquake located there could have been felt in the way the 1940 event was described. A magnitude 3.2 earthquake occurred at the head of Belle Bay (about 170 km to the east of the 1940 event) on 23 March 1975 and was reported to have been felt at Pool's Cove and Rencontre East (Wetmiller, 1977). Thus the 1940 event could have been a similar local earthquake.

1951 June 27, 1954 August 29, 1954 October 16

These three magnitude 5 earthquakes occurred on the Laurentian Slope south of Newfoundland and east of Nova Scotia, but apparently have no record of being felt in Newfoundland. In 1983 F. Lombardo, station operator of GBN, made local enquiries in Guysborough, Nova Scotia, 400 km west of the epicentre. At least one of the 1954 earthquakes and a later, similar-sized earthquake in 1975 rattled dishes, doors, and windows. However, such inconsequential reports were apparently not recorded in the local newspapers (F. Lombardo, written communication, 1983, EPB file 6265-20).

1956 January 05

Mild earthquake in the northern Avalon Peninsula. Like to 1884 earthquake, rumbling sounds accompanied the ground shaking. The north-south extent of the felt area is 70 km (Figure 6b) and, assuming this to be the major axis of an ellipse with a 2:1 axial ratio, the felt area is 2000 km². Applying the formulation of Nuttli and Zollweg (1974) gives a calculated magnitude of 3.5. The maximum felt intensity approximates MM IV and suggests a magnitude of 3 1/2 (from $M = 1 + 2I/3$, Smith, 1966). A magnitude of 3.5 is assigned.

Seismograph records from Halifax and Seven Falls were examined as set out in Table 3. Both records were quiet with no trace of seismic signal. The calculations indicate an upper limit on the size of the earthquake of $M=3.5$ ($m_b(Lg)$). Hence it is concluded that an earthquake M 3.5 near 47.8°N, 53.3°W should be added to the epicentre file.

1957 January 28 (Francois)

Not an earthquake.

1957 January 28 (Grates Cove)

Minor earthquake near north tip of Bay de Verde Peninsula. The newspaper report suggests it was not felt in more southern communities on the Peninsula, and Staveley's research suggests it was not felt in Port Union on the north side of Trinity Bay. Thus this is likely to be a magnitude 3 earthquake near 48.3°N, 52.9°W.

1965 November 15

This earthquake was instrumentally located near Deadman's Bay in EPB's catalogue. However, newspapers report the earthquake being felt only at Bonavista, Catalina, Little Catalina, and Port Union, all on the tip of the Bonavista Peninsula (Figure 5). Thus the felt reports were all about 90 km southeast of the epicentre and raised doubts about the instrumental epicentre.

A new examination of the seismograms for the event confirm that the previous epicentre is in error. Clear phase readings from the St. John's seismograph give an S_1-P_1 of 16.0 seconds and hence a distance of 140 km (the previous epicentre was placed 215 km from St. John's). A new computation (Table 4) places the epicentre 15 km north of Bonavista, and so confirms the felt reports. In addition, the magnitude must be revised downwards to 3.7, due to the change in epicentral distances, making it more consistent with the felt reports and likely felt area. The earthquake was felt for 35 km south of the epicentre, and so if a circular felt region is assumed, the felt area is 3800 km², which, applying the formulation of Nuttli and Zollweg (1974), gives a calculated magnitude of 3.7.

1969 February 02

Felt mildly in Lewisporte, Grand Falls, Windsor, and La Scie. Reports of wells collapsing and basement walls cracking in Lewisporte were not confirmed and seem unlikely for this size earthquake. The previous instrumental epicentre was in Notre Dame Bay, but a new computation (Table 4) based on re-reading of seismograms and rejection of some data placed it onshore and further south. The felt area was approximately 7200 km² (Figure 5), with La Scie being somewhat further from the new epicentre than the other felt localities. Applying the formulation of Nuttli and Zollweg (1974) gives a calculated magnitude of 3.8, in fair agreement with the instrumental magnitude of 3.6.

1969 August 05

Earthquake in EPB catalogue, 35 km offshore of St. John's. Although not reported felt, an earthquake of this size could well have been felt in St. John's. The new location in Table 4 moves the epicentre 9 km to the north and reduces the magnitude to 3.3. The change in location is due in part to an increase in data used in the computations.

1971 December 07

Event in EPB catalogue, in Labrador Sea, not reported felt.

1975 March 23

Known to have been felt (intensity III-IV) at Pool's Cove and Rencontre East (Wetmiller, 1977). Not reported in St. John's newspapers.

1975 October 06

Event in EPB catalogue, not reported felt.

1979 July 20

Event in EPB catalogue, not reported felt.

ADDITIONAL EVENTS IN 1985

Early in 1985, as this open-file was being completed, two seismic events were felt near Buchans. The events are well summarized in a 2nd April 1985 letter from R. Wetmiller, EPB, to the Mayor of Buchans (EPB file 4215-7): "Presently, seismograph stations are operated at St. John's and Corner Brook in Newfoundland. Three events near Buchans have been detected by these stations in 1985. The details are:

<u>Date</u>	<u>Time</u>	<u>Magnitude</u>	<u>Comment</u>
17 Jan. 85	03:54 NST	M 3.0	Felt
19 Mar. 85	15:42 NST	M 2.5	Not reported
22 Mar. 85	11:06 NST	M 2.6	Felt

The first and last events noted were widely felt in your community and were well recorded on the seismograph station at Corner Brook. The other event was not reported felt, but is identical to the other two on the Corner Brook records, so I suspect it was another event near Buchans. Perhaps it was not reported felt because it occurred during the afternoon when people are most busy.

The three seismic events noted are probably "rockbursts" in the Buchans mine. However, it is impossible to prove this with the seismograph records available as the signatures of rockbursts and natural earthquakes are almost identical. Earthquake activity is rare on the island of Newfoundland, but small events are not unknown. Rockburst activity is associated with working or abandoned mines in many parts of Canada and the world, so the Buchans mine could be subjected to the same sort of events, although I gather there is no history of such activity prior to 1985. Whatever their cause, it is unlikely that the events pose a threat to your community."

CHANGES TO CANADIAN EARTHQUAKE EPICENTRE FILE (CEEF)

Old and revised values for the epicentres are given in Table 5. The changes are all justified in the assessment above.

COMPLETENESS OF THE NEWFOUNDLAND EARTHQUAKE RECORD

For estimating seismic risk by the Cornell-McGuire method currently applied by the Earth Physics Branch (Basham et al., 1982), it is necessary to know both the earthquake record and some assessment of its completeness. The need for completeness was the main reason for insisting the contractor undertake a painstaking examination of the newspapers, including those not apparently containing earthquake information.

Even when earthquake information is absent, deductions can be made about the completeness. For example, Staveley notes that foreign earthquakes were widely reported during the 1800's, leading him to conclude that local earthquakes, had they been felt, would have received similar attention. Other evidence leads to similar confidence in the record. In reference to the 1884 earthquake, one newspaper remarked "we anxiously await further particulars of a phenomenon of such rare occurrence in this colony" (emphasis added), clearly suggesting that previous earthquakes had not been felt during the lifetime of the editors.

Reports of new earthquakes sometimes trigger the memory of earlier ones. The 1929 earthquake appears to have recalled memories of the 1925 Charlevoix earthquake (but not of other unknown events). The later 1940 and 1956 earthquakes were compared directly to the 1929 earthquake, implying by omission that there had been no intervening events in each place.

Such evidence can be used to make the following conclusions about the history of local earthquakes in eastern Newfoundland.

Pre 1755	no data collected
1755-1810	incomplete data, no newspapers; colonial records not searched systematically
1810-1914	(less 1818-1827 - issues missing) good newspaper record, probably complete to $M \geq 4.5$ for local earthquakes
1914-1937	newspapers not searched systematically. Probably complete for $M \geq 5$
1937-1956	instrumental record complete for $M \geq 5$
1956-1964	instrumental record complete for $M \geq 4.5$
1964-1976	St. John's seismograph station operating, complete for $M \geq 3.5$
1977-present	Corner Brook seismograph station operating, complete for $M \geq 3.0$.

The same data would suggest that a magnitude 7 offshore earthquake within about 600 km of St. John's would have been recorded if it had happened since 1810 and possibly since 1755.

The earthquake record of Labrador is much less complete and needs a detailed study of its own. The reports of the 1809 earthquake would suggest that there is the potential for magnitude 7 offshore events to have been completely reported since the founding of the Moravian missions in 1757.

FURTHER WORK REQUIRED

While the present work is sufficiently complete to merit this publication, the following points could be researched to fully complete the task:

- search Royal Gazette for 1818-1827
- search for French records from St. Pierre-Miquelon
- a search of non-newspaper sources for the period 1755-1810
- a study of the Moravian records for Labrador earthquakes
- a detailed study of the 1929 earthquake effects

ACKNOWLEDGEMENTS

I thank Dr. Anne Stevens for her advice and encouragement during the initiation and analysis of this contract. Her detailed criticism of the draft manuscript resulted in useful improvements. A good working relationship with M. Staveley during the contract ensured a quality product delivered on time. The work was funded by the Office of Energy Research and Development of Energy, Mines and Resources Canada as part of Earth Physics Branch research into seismology and seismic hazard of the eastern continental margin.

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COLLECTED TABLES AND FIGURES

TABLE CAPTIONS

- Table 1. Summary of events investigated.
- Table 2. Editorial comments on earthquake activity 1828-1900.
- Table 3. Results of examining Halifax and Seven Falls seismograph records for evidence of the 1940 and 1956 earthquakes.
- Table 4. New computer solutions for three Newfoundland earthquakes 1965-1969. Note: The table represents EPB's standard earthquake solution computer output. Its details are intended as a matter of record only.
- Table 5. Original entries in the Canadian Earthquake Epicentre File (first line) and intended changes (second line) for each event.

FIGURE CAPTIONS

- Figure 1. Diagram showing the years systematically searched for each newspaper.
- Figure 2. Folk song recording the 1755 tsunami at Bonavista. (From Omar Blondahl, 1955?. Newfoundlanders, Sing! A collection of Favorite Newfoundland Folk Songs, 1st Ed.
- Figure 3. XVIII Century plan of Bonavista showing Corneil Rock. (Taken from Prowse, 1895 p. 239.)
- Figure 4. Map of northern Nova Scotia, southern Newfoundland and the adjacent shelf and slope showing: earthquake epicentres from 1909-1980; seismograph stations (triangles); and the 200 m and 2000 m isobaths. Note concentration of earthquakes at the mouth of the Laurentian Channel. (Taken from Basham and Adams, 1982).
- Figure 5. Map of the island of Newfoundland showing localities mentioned, revised earthquake epicentres and ellipses showing approximate felt area for five of the earthquakes. Localities on the Avalon Peninsula at which the 1884 and 1956 earthquakes were felt are shown in detail in Figure 6.
- Figure 6. Localities, felt ellipses and suggested epicentre
A) for the March 1884 earthquake on the Avalon Peninsula and
B) for the 1956 earthquake on the Bay de Verde Peninsula.

TABLE 1

Summary of Events Investigated.

<u>Year</u>	<u>Date</u>	<u>Place</u>	<u>Comments</u>
1755	Nov. 01	Bonavista	tsunami, not a local earthquake
1775		Burin	not an earthquake
1809	Jan. 21	Labrador	earthquake plus aftershocks
1836	Nov. 30	Labrador	earthquake
1837c.	winter	Bonavista	not a local earthquake
1857	Jan. 12	Labrador	earthquake
1864	Jun. 27	Southern Avalon	possible tsunami
1884	Mar. 18	Northern Avalon	earthquake
1890	July 23	St. John's	not an earthquake
1907	Jan. 20	Old Perlican	sea waves
1909	Dec. 20	Cape Breton	earthquake not recorded felt in Newfoundland
1922	July 26	Offshore	earthquake not recorded felt in Newfoundland
1924	March	Deer Lake	probably 1925 Charlevoix earthquake
1925		Bonne Bay	unconfirmed wave
1934	Jun. 15	Labrador	earthquake not recorded felt in Newfoundland
1940	Apr. 11	South Coast	probable new earthquake
1951	Jun. 27	Offshore	earthquake not recorded felt in Newfoundland
1954	Aug. 28	Offshore	earthquake not recorded felt in Newfoundland
1954	Oct. 16	Offshore	earthquake not recorded felt in Newfoundland
1956	Jan. 05	Northern Avalon	new earthquake
1957	Jan. 28	Francois	not an earthquake
1957	Jan. 28	Grates Cove	new earthquake
1965	Nov. 15	Bonavista	felt earthquake
1969	Feb. 02	Notre Dame Bay	felt earthquake
1969	Aug. 05	Offshore St. John's	earthquake not recorded felt in Newfoundland
1971	Dec. 07	Labrador	earthquake not recorded felt in Newfoundland
1975	Mar. 23	Fortune Bay	earthquake felt, but not reported in newspapers
1975	Oct. 06	Offshore	earthquake not recorded felt in Newfoundland
1979	Jul. 20	Offshore	earthquake not recorded felt in Newfoundland

Table 2

Editorial Comments on Earthquake Activity 1828-1900

<u>PAPER</u>	<u>SUBJECT/HEADLINE</u>	<u>ISSUE NUMBER AND DATE</u>
Royal Gazette	Eyewitness Account of 1755 Lisbon earthquake	5 August 1828
Royal Gazette	Italy - Earthquake	#1276 17 April 1832
"	Earthquake in Canada	1357 12 November 1833
"	Earthquake in South America	1396 12 August 1834
Public Ledger	Saluting an Earthquake	1397 2 September 1836
Royal Gazette	Earthquakes	1640 25 June 1839
"	Dreadful Earthquake in Burmah	1665 17 December 1839
"	Earthquake in Nova Scotia	21 March 1848
"	Earthquake in Azores	13 February 1849
Public Ledger	The Earthquake at Antigua	2074 6 September 1850
Royal Gazette	Earthquake in the East	2489 27 January 1852
"	Earthquake in Dublin	2535 ? November 1852
Public Ledger	Earthquake in England	2308 2 December 1852
"	Earthquake in Malaga	2309 7 December 1852
Royal Gazette	Earthquake at Acapulco/China	2543 8 February 1853
"	Kausuch+Manilla (sic)-Phillipines?	2544 15 February 1853
Public Ledger	Earthquakes in Greece	2384 29 November 1853
Royal Gazette	Earthquakes in Calabria	2631 ? June 1854
Public Ledger	Terrible Earthquake in New Zealand	2568 19 June 1855
"	Earthquake at Baltimore	2575 13 July 1855
"	Recent Earthquake in the Mediterranean	2744 2 December 1856
"	Total Eclipse of 22 December 1870: Earthquake and Tidal Wave	63 2 December 1870
"	The Pope and the Earthquake	31 22 August 1873
Royal Gazette	South American Earthquake	32 7 August 1877
"	Last Year's Earthquakes	10 June 1884
"	Earth Movements	16 17 April 1894
"	...a new continuous-record seismograph	46 3 November 1894
"	Earthquake regions	44 29 October 1895
"	Earthquake Survey	38 15 September 1896
"	Earthquakes in the North and South of Europe and Asia	44 3 November 1896
Royal Gazette	Earthquake Tremors that only animals feel	46 10 November 1896
"	Japanese Seismic Wave	12 23 March 1897
"	Progress in Seismology	14 6 April 1897
"	A Glacier Volcano	32 10 August 1897
"	An Earthquake's Force	48 30 November 1897
"	All Earth Tremors to be recorded	8 22 February 1898
"	The Earthquake's Home	38 23 August 1898

TABLE 3

Results of examining Halifax (HAL) and Seven Falls (SFA) seismograph records for evidence of the 1940 and 1956 earthquakes. The maximum size for the 1940 and 1956 earthquakes has been determined by the lack of seismic signal on the seismograms. Instrument parameters are taken partly from Stevens (1980) and partly from references in that paper.

Station	Instrument	Approximate Magnification (K)	Epicentral Distance (km)	Maximum* Amplitude (mm)	Assumed Period** (sec)	Maximum Magnitude (Mb(Lg))
1940 April 11						
HAL	Bosch NS, EW	0.125	630	0.1	?	?
SFA	Wood Anderson EW	2.0	1100	0.2	0.4	4.5
1956 January 05						
HAL	SPZ Benioff	28	900	0.3	0.3	3.4
SFA	SPZ Benioff	36	1300	0.3	?	3.4

* that could have been read as an earthquake phase

** expected period of maximum amplitude short period seismic waves if the earthquake had been recorded on the seismograph.

*48.82 - 53.01 F1MN=3.7 111224. 15111965 0 0.02 0.05 0.3 4 9 4 0.4 218STJ 140
 FELT BUNAVISTA PENN. EPICENTRE IS 15 KM N OF BUNAVISTA
 WAS PLACED 95 M TU NW AND AT M4.0
 SHAL: AMPL READ FROM SW BUT THIS MAY HAVE BEEN ATTENUATED
 SSIC: VERY NOISY AND HARD TO READ

140 KM N FROM ST. JOHN'S, NFLD.	140 KM N	UE ST-JEAN, T.-N.									
140 KM N FROM ST. JOHN'S, NFLD.	140 KM N	UE ST-JEAN, T.-N.									
STJ651115112P	A12475 C	A13037	13035	040	52	27		1			
STJ S 140KM	171	49	18	41	18	-25	4	-35	8156	34ML30MN	
MAL651115112P 814230			815222	X1644	050	100	15				1
MAL SW 433KM 4 -07	244	49				-42		-164	188		33MN
SIC651115112P C14370			81609	X1657	050	105	47				1
SIC N 1000KM 1 4488	284	49				4	46	-867#	562		38MN
SCM651115112P A14510			A16409	X17420	040	85	4				1
SCM NW 1254KM 10 -26	310	49				10	13	-689#	739		41MN
6511151112Z											

*49.43 - 53.40 F1MN=3.0 142431. 02021969 1 0.05 0.07 0.4 5 10 7 1.7 218STJ 200
 FELT LEWISTON, GRAND FALLS, WINDSOR, LASCIE. NO DAMAGE CONFIRMED
 MNT: SWELL FROM NOT SEEN
 STJ: VERY WEAZY PN, LG ONSET DIFFICULT TO IDENTIFY
 SHAL: POUR LG
 SCM: GOOD PH AND SW
 SSIC: NOT OPERATING
 MNT: GOOD SW VERY POUR LG
 GWC: POUR PN, SW

290 KM W FROM ST. JOHN'S, NFLD.	290 KM NW	UE ST-JEAN, T.-N.									
290 KM W FROM ST. JOHN'S, NFLD.	290 KM NW	UE ST-JEAN, T.-N.									
STJ6902020425P A25112	25165	A25422	X2551	020	35	140					1
STJ SW 280KM 14	11	135	49	4	-31	14	42	16	12500	40ML43MN	
MAL6902020425P A26155						A27355	X2823	040	66	18	1
MAL SW 620KM 14 -16	233	49				14	51	256	428		36MN
SCM6902020425P A26323						A28128	X2858	050	78	45	1
SCM NW 492KM 14 -376	312	49				14	322	-703#	725		39MN
SFA6902020425P 26288						28488	X30055	070	39	6	1
SFA N 1172KM 4 710	263	49				4	-110	648#	138		33MN
MNT 6902020425P						29455	X3120	070	90	7	1
MNT N 1434KM	254	49				4	-107	637#	70		32MN
GWC6902020425P X27515						X3029	X3203	080	42	10	1
GWC NW 1044KM -503#	302	49					-232	-957#	167		37MN
FBL6902020425P								X3234	090	39	4
FBL N 1178KM	334	49						-1461#	72		34MN
6902020425Z											

*47.74 - 52.31 F1MN=3.4 215322. 05081969 1 0.04 0.11 0.2 6 10 4 1.0 218STJ 37
 MNT REPORTED AS FELT IN ST JOHN'S NEWSPAPERS DESPITE CLOSENESS
 COMMENT FROM LAKS. FM IS CNW - EVENT FROM ALMOST DUE EAST
 SHAL: LG USED FOR MAGNITUDE, MAY BE ATTENUATED

35 KM NE FROM ST. JOHN'S, NFLD.	35 KM NE	UE ST-JEAN, T.-N.									
35 KM NE FROM ST. JOHN'S, NFLD.	35 KM NE	UE ST-JEAN, T.-N.									
STJ6908052153P	A53288 C	B53333									1
STJ SW 37KM	240-63	21	-31					5	-70		
MAL6908052153P B5523						B5652	X5746	040	66	6	1
MAL N 437KM 5 63	253	49				5	28	97	143		32MN
SIC6908052153P A55421								B58275	050	106	10
SIC N 1090KM 21 109	290	49						5	-27	119	32MN
SCM6908052153P A56032								B5922	050	72	11
SCM NW 1270KM 21 -73	313	49						5	163	192	35MN
SFA6908052153P B56190											1
SFA N 1390KM 5 61	274	49									
GWC6908052153P								6224	090	35	4
GWC NW 1443KM	305	50						5	-277	60	35MN
6908052153Z											

Table 4. New computer solutions for three Newfoundland earthquakes 1965-1969.

TABLE 5

Original entries in the Canadian Earthquake Epicentre File (first line) and intended changes (second line) for each event.

	DATE	TIME (UT)	Lat (°N)	Long (°W)	Magnitude	
					ML	Mb(Lg)
1.	1857 01 12		58.2	62.6	3.7	
2.	1864 07 28 06 27	22 30	46.5	53.7	4.4	
3.	1884 03 18	18 30 16 45	47.2 47.8	53.0 53.3	4.3	4.1
4.	1922 07 26	07 31 08 06	50.0	50.0	5.3	
5.	New Event 1940 04 11	04 30	47.6	57.1		3.6
6.	New Event 1956 01 05	14 50	47.8	53.3		3.5
7.	New Event 1957 01 28		48.3	52.9		3.0
8.	1965 11 15	11 12 30 24	49.37 48.82	53.66 53.01	4.0	3.7
9.	1969 02 02	04 24 38 31	49.71 49.43	55.13 55.40		3.5 3.6
10.	1969 08 05	21 53 23 24	47.66 47.74	52.29 52.31		3.4 3.3

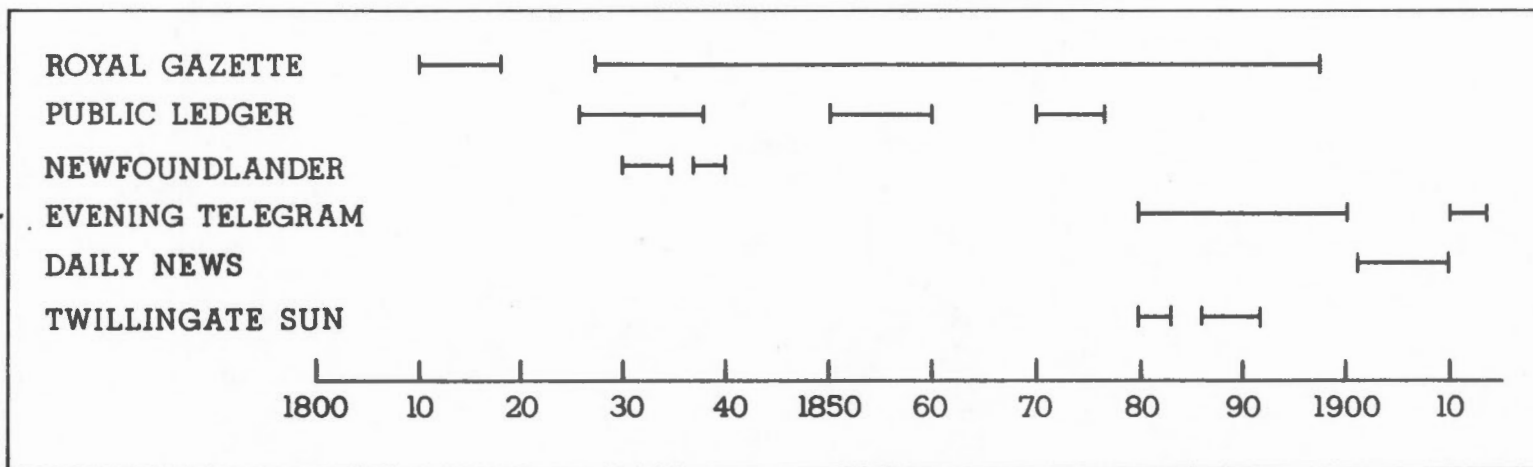


Figure 1. Diagram showing the years systematically searched for each newspaper.

A Great Big Sea Hove In

The musical score is written for a single melodic line in 2/4 time. It begins with a treble clef and a key signature of one flat (B-flat). The tempo/mood is marked 'brightly' and the dynamic is 'f' (forte). The score consists of four staves of music. The first staff has a 'C7' chord marking above it. The second staff has a 'C7' chord marking above it and includes the lyrics '(Right fol - or - al fah didd - le I - do)'. The third staff has 'F7' and 'Bb' chord markings above it, and a 'C7' chord marking above the final measure. The fourth staff has 'C7' chord markings above the first and third measures, and a 'f' dynamic marking above the final measure.

A great big sea hove in Long Beach.
 Right fol-or-al, fah diddle-I-do!
 A great big sea hove in Long Beach
 And Granny Snooks she lost her speech!
 To me right fol-diddy fi-day!

A great big sea hove in the Harbour,
 Right fol-or-al, fah diddle-I-do!
 A great big sea hove in the Harbour
 And hove right into Keough's parlour!
 To me right fol diddy-fi-day!

Oh, dear mother, I wants a dress!
 Right fol-or-al, fah diddle-I-do!
 Even though it be a sack
 With beads and buttons all down the back!
 To me right fol diddy-fi-day!

Me boot is broke and me frock is tore.
 Right fol-or-al, fah diddle-I-do!
 Me boot is broke and me frock is tore..
 But Georgie Snooks I do adore!
 To me right fol diddy-fi-day!

Oh, fish is low and flour is high.
 Right fol-or-al, fah diddle-I-do!
 Fish is low and flour is high
 So Georgie Snooks he can't have I!
 To me right fol diddy-fi-day!

But he will have me in the fall,
 Right fol-or-al, fah diddle-I-do!
 And if he don't I'll hoist me sail
 And sail right out of old Cannaille!
 To me right fol diddy-fi-day!

—Traditional.

This wonderful little song probably dates back to the late 1800's: It was sung and played everywhere in Newfoundland.

Figure 2. Folk song recording the 1755 tsunami at Bonavista. (From Omar Blondahl, 1955?. *Newfoundlanders, Sing! A collection of Favorite Newfoundland Folk Songs*, 1st Ed.

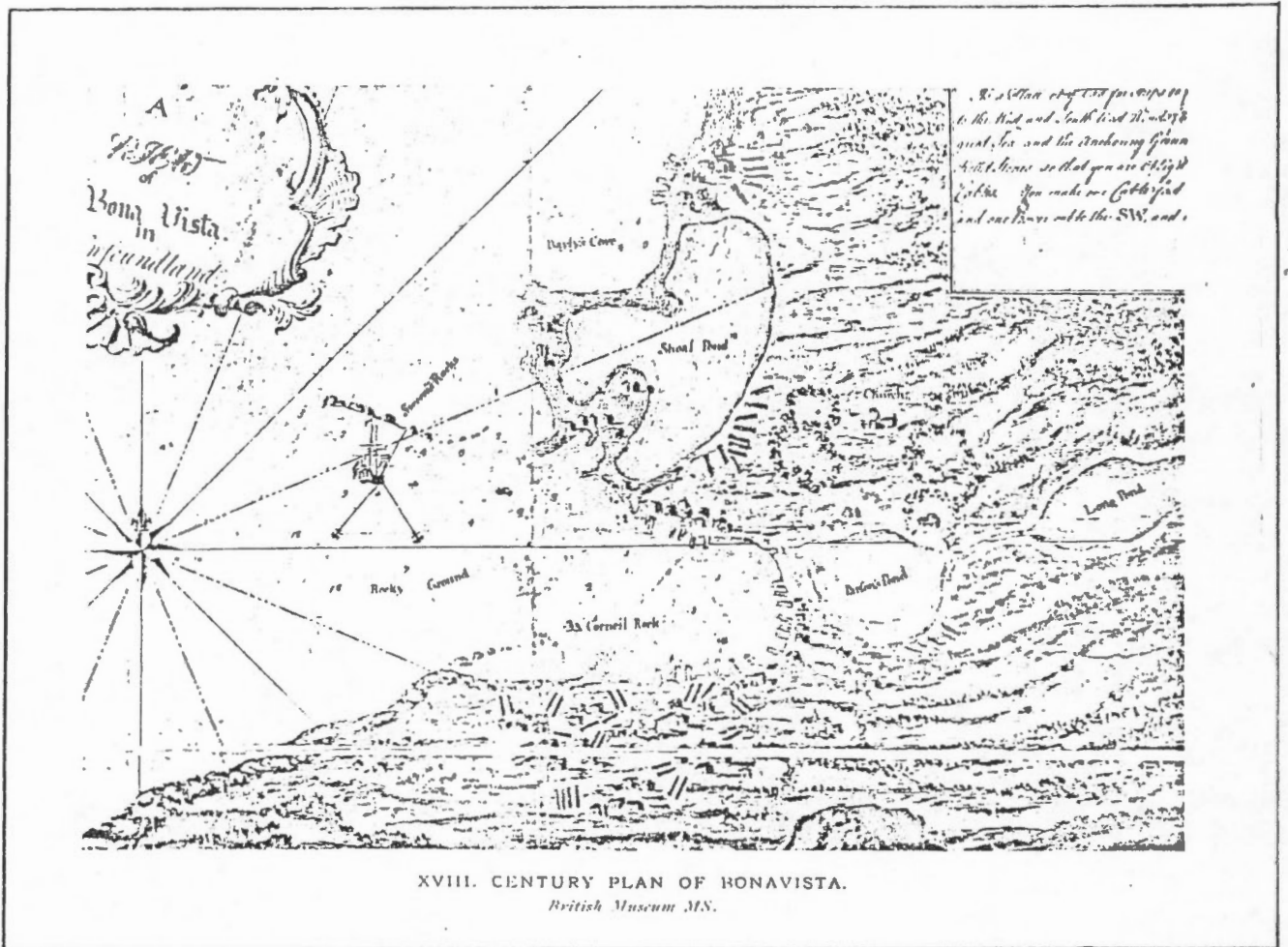


Figure 3. XVIII Century plan of Bonavista showing Corneil Rock. (Taken from Prowse, 1895 p. 239.)

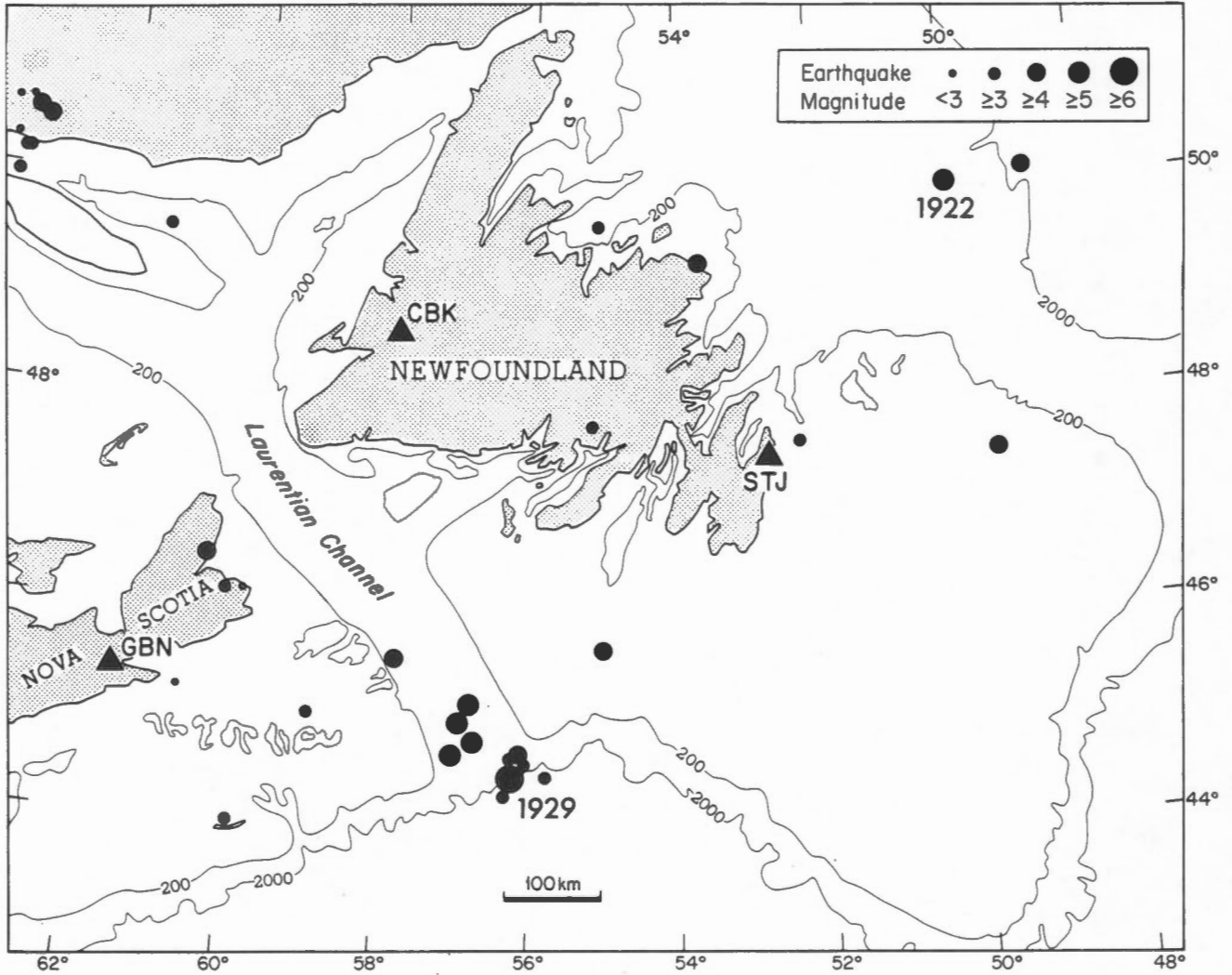


Figure 4. Map of northern Nova Scotia, southern Newfoundland and the adjacent shelf and slope showing: earthquake epicentres from 1909-1980; seismograph stations (triangles); and the 200 m and 2000 m isobaths. Note concentration of earthquakes at the mouth of the Laurentian Channel. (Taken from Basham and Adams, 1982).

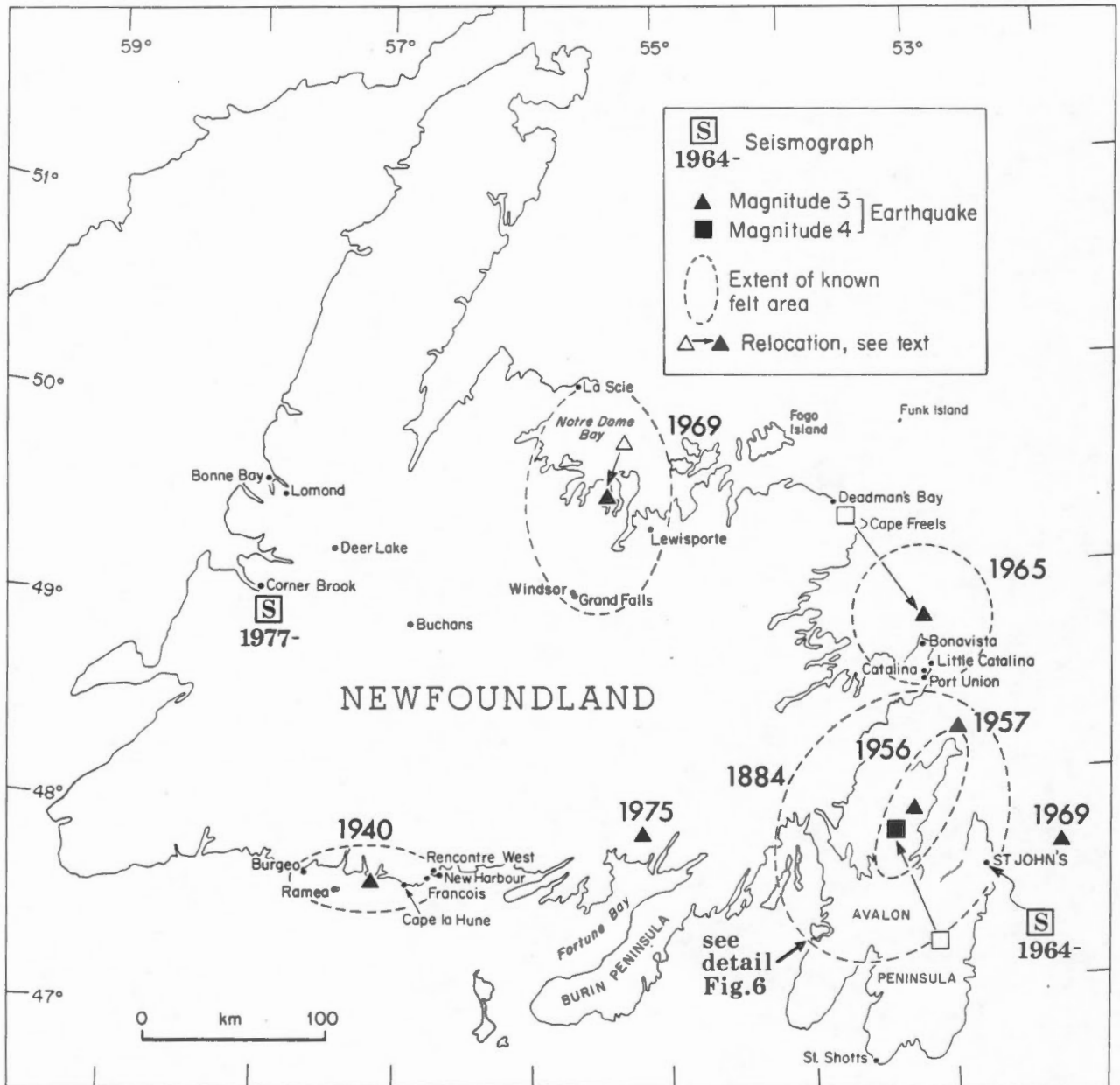


Figure 5. Map of the island of Newfoundland showing localities mentioned, revised earthquake epicentres and ellipses showing approximate felt area for five of the earthquakes. Localities on the Avalon Peninsula at which the 1884 and 1956 earthquakes were felt are shown in detail in Figure 6.

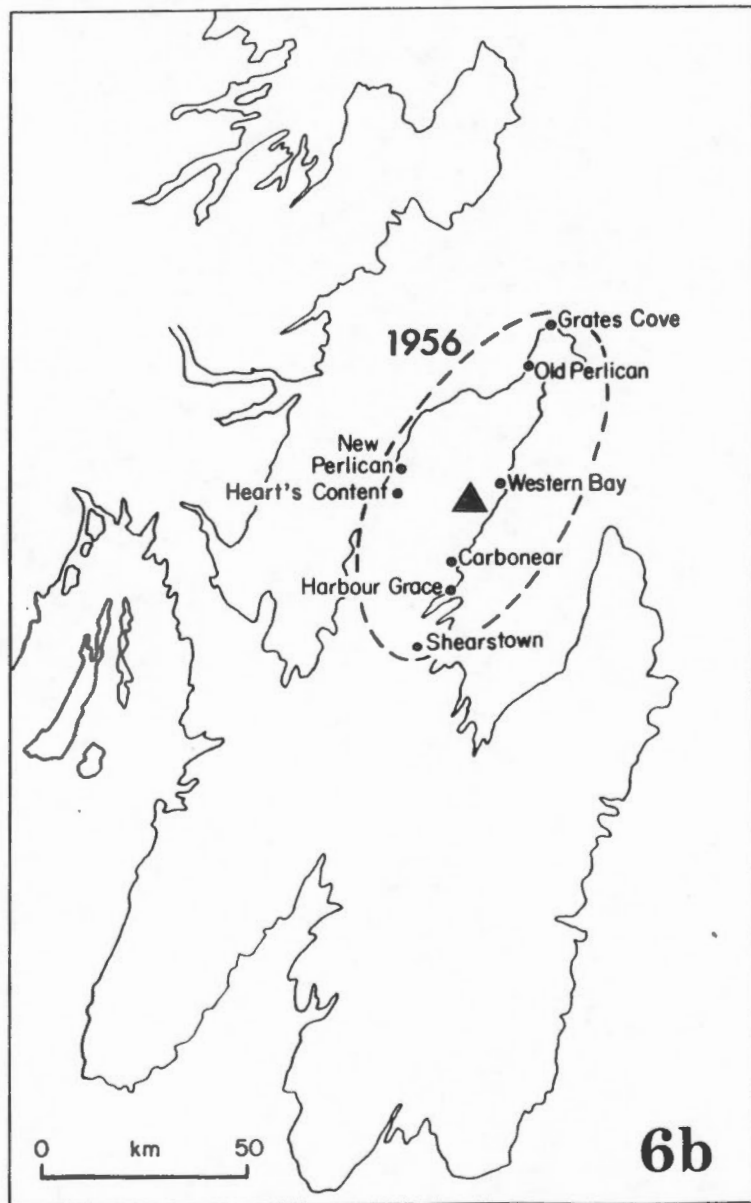
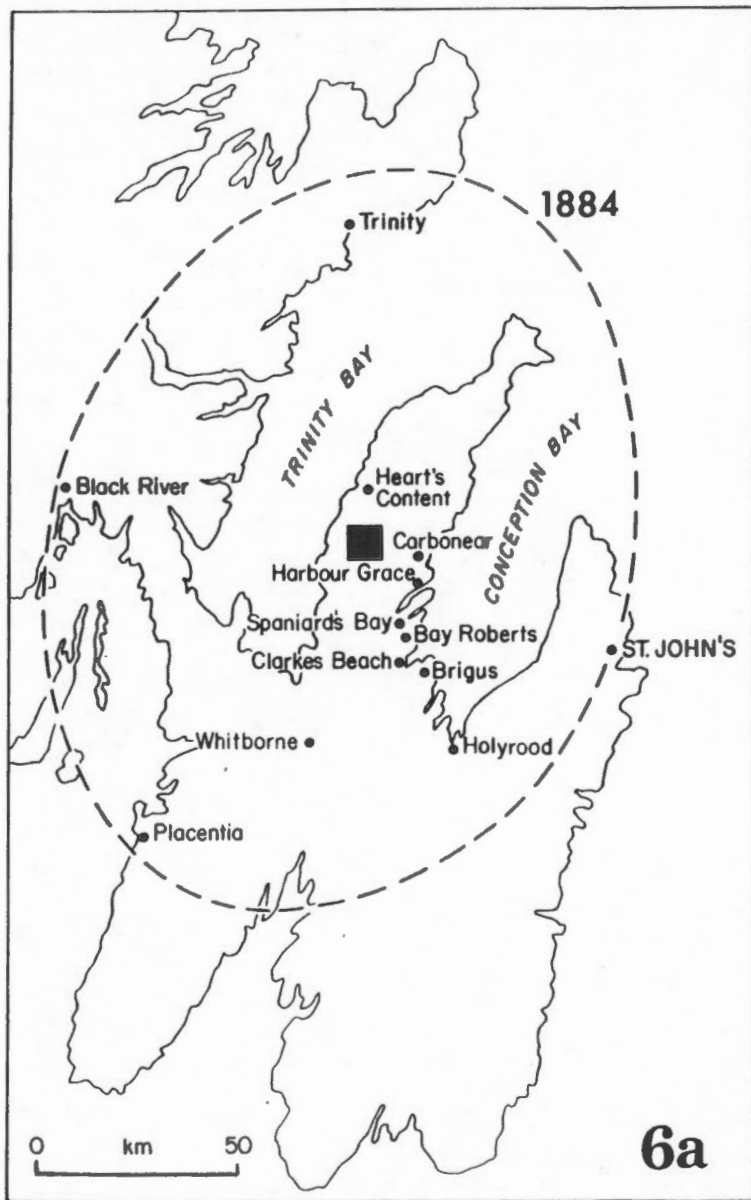


Figure 6. Localities, felt ellipses and suggested epicentre
 A) for the March 1884 earthquake on the Avalon Peninsula and
 B) for the 1956 earthquake on the Bay de Verde Peninsula.

