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Felt reports and damage accounts for the 1925 Moment Magnitude 6.2 Charlevoix, Quebec, earthquake

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Abstract

The 28 February 1925 magnitude 6.2 Charlevoix Earthquake occurred at 9:19 p.m. local time. The epicenter was beneath the St. Lawrence River in the Charlevoix-Kamouraska area. The shock was felt at more than 1000 km from the epicenter. In the following weeks, dozens of aftershocks continued to shake the area, keeping residents on both sides of the St. Lawrence River on high alert. Damage was reported on both sides of the River in the epicentral zone, as well as in the cities of Québec and Shawinigan. In these areas, chimneys and masonry buildings proved particularly sensitive to the ground vibrations. The 1925 earthquake is one of five known moment magnitude 5.5-7 events that have occurred in the Charlevoix Seismic Zone (CSZ) between 1663 and present. This Open File Report presents the macroseismic information and its ratings on the Modified Mercalli Scale for a total of more than 600 locations in Canada and some 180 in the United States (from NOAA). This report builds on the macroseismic information published in Cajka (1999) and adds descriptive information for each locality where damage occurred. For each location, the felt information is rated on the Modified Mercalli intensity (MMI) scale and tabulated in a Microsoft Excel sheet. Numerous images of clippings of newspaper articles are included and the descriptive text is added to the database. In addition, photographs of the earthquake damage are included. The Open File also provides a GoogleEarth kmz file that allows the felt information reports to be viewed in a spatial tool.

Résumé

Le tremblement de terre de Charlevoix du 28 février 1925, d'une magnitude de 6,2, s'est produit à 21 h 19, heure locale. L'épicentre se trouvait sous le fleuve Saint-Laurent dans la région de Charlevoix-Kamouraska. Le choc a été ressenti à plus de 1000 km de l'épicentre. Au cours des semaines qui suivirent, des dizaines de répliques ont continué à secouer la région, maintenant les résidents des deux rives du fleuve Saint-Laurent en état d'alerte. Des dommages ont été signalés des deux côtés du fleuve dans la zone épicentrale, ainsi que dans les villes de Québec et de Shawinigan. Dans ces régions, les cheminées et les bâtiments en maçonnerie se sont avérés particulièrement sensibles aux vibrations du sol. Le tremblement de terre de 1925 est l'un des cinq événements connus de magnitude 5,5-7 qui se sont produits dans la zone sismique de Charlevoix (CSZ) entre 1663 et aujourd'hui. Ce dossier public présente les informations macroséismiques et leurs niveaux sur l'échelle de Mercalli modifiée pour un total de plus de 600 endroits au Canada et quelque 180 aux États-Unis (de la NOAA). Ce rapport s'appuie sur les informations macroséismiques publiées dans Cajka (1999) et ajoute des informations descriptives pour chaque localité où des dommages se sont produits. Pour chaque lieu, les informations sur le ressenti sont évaluées sur l'échelle d'intensité de Mercalli modifiée (MMI) et présentées sous forme de tableau dans un tableau Microsoft Excel. De nombreuses images de coupures de presse sont incluses et un texte descriptif est ajouté à la base de données. De plus, des photographies des dommages causés par le tremblement de terre sont incluses. Le dossier public fournit également un fichier kmz de GoogleEarth qui permet de visualiser les rapports d'information macroséismique dans un outil spatial.

Plain language summary:

The 28 February 1925 magnitude 6.2 Charlevoix Earthquake occurred at 9:19 p.m. local time. This Open File Report presents the macroseismic information and its ratings on the Modified Mercalli Scale for a total of more than 600 locations in Canada and some 180 in the United States (from NOAA). For each location, the felt information is rated on the Modified Mercalli intensity (MMI) scale and tabulated in a Microsoft Excel sheet. Numerous images of clippings of newspaper articles are included and the descriptive text is added to the database. In addition, photographs of the earthquake damage are included. The Open File also provides a GoogleEarth kmz file that allows the felt information reports to be viewed in a spatial tool.

Résumé en langage simple

Le tremblement de terre de Charlevoix du 28 février 1925, d'une magnitude de 6,2, s'est produit à 21 h 19, heure locale. Ce dossier public présente les informations macroséismiques et leurs niveaux sur l'échelle de Mercalli modifiée pour un total de plus de 600 endroits au Canada et quelque 180 aux États-Unis (de la NOAA). Ce rapport s'appuie sur les informations macroséismiques publiées dans Cajka (1999) et ajoute des informations descriptives pour chaque localité où des dommages se sont produits. Pour chaque lieu, les informations sur le ressenti sont évaluées sur l'échelle d'intensité de Mercalli modifiée (MMI) et présentées sous forme de tableau dans un tableau Microsoft Excel. De nombreuses images de coupures de presse sont incluses et un texte descriptif est ajouté à la base de données. De plus, des photographies des dommages causés par le tremblement de terre sont incluses. Le dossier public fournit également un fichier kmz de GoogleEarth qui permet de visualiser les rapports d'information macroséismique dans un outil spatial.

Introduction

The 28 February 1925 Moment Magnitude (**M**) 6.2 Charlevoix earthquake is among the strongest earthquakes reported or recorded in eastern Canada. In addition to the 1925 earthquake, four other earthquakes with Moment Magnitude (**M**) between 5.5 and 7 are known to have occurred in the Charlevoix Seismic Zone (CSZ): 1663 (**M** ~ 7); 1791 (**M** ~ 5.5); 1860 (**M** ~ 6); and 1870 (**M** ~ 6.5). Due to these damaging earthquakes and the frequent lower magnitude earthquakes, the CSZ is recognized as the most active seismic zone of eastern Canada. This earthquake was recorded at teleseismic distances allowing its **M** to be calculated at 6.2 (Bent, 1992). Historically, the 1925 event was also called the St. Lawrence earthquake by E.A Hodgson, the La Malbaie earthquake by some or more recently, the 1925 Charlevoix earthquake (Cajka, 1999).

The evening of the main shock, the seismologist of the Dominion Observatory in Ottawa, Dr. E.A. Hodgson (Figure 1), was able to locate the epicentre near the mouth of the Saguenay River using the records from the Ottawa seismograph. He first deduced the azimuth from the relative amplitudes of the north-south and east-west components; then he calculated the epicentral distance from the difference in arrival times between the P- and S-waves. He was able to tell the press about the epicentre the very same evening, which was remarkable at the time. The damage documented during field work added weight to the location of the epicentre along the St. Lawrence River, somewhere between La Malbaie and Rivière-Ouelle (Hodgson, 1950). Years later, re-analysis of the arrival times on a number of seismograms relocated the epicentre near Ile aux Lièvres, in the NE corner of the CSZ (Stevens, 1980).

Figure 1. Dr E.A. Hodgson, seismologist with the Dominion Observatory in Ottawa. Photograph by G.F. Berton, NRCan Photo Database number 1995155.

The main shock occurred on 28 February 1925 at 9:19 p.m. local time when most people were awake. The earthquake was felt over a large part of northeastern North America and made the front page of most newspapers over this vast region. Based on the intensity questionnaires filled by postmasters and a number of newspaper accounts, it is known that the earthquake was felt as far east as southwestern Newfoundland, Sault Ste. Marie, Ontario, to the west, and Virginia, to the south (Figure 2). The northern limit is more difficult to determine due to the sparse population distribution and the limited communications at the time, but it was reported felt on the eastern shore of James Bay Chisasibi, Quebec, more than 900 km from the epicentre. According to newspaper reports and eyewitness accounts, the earthquake had a major psychosocial impact on the local population on both shores of the St. Lawrence River.

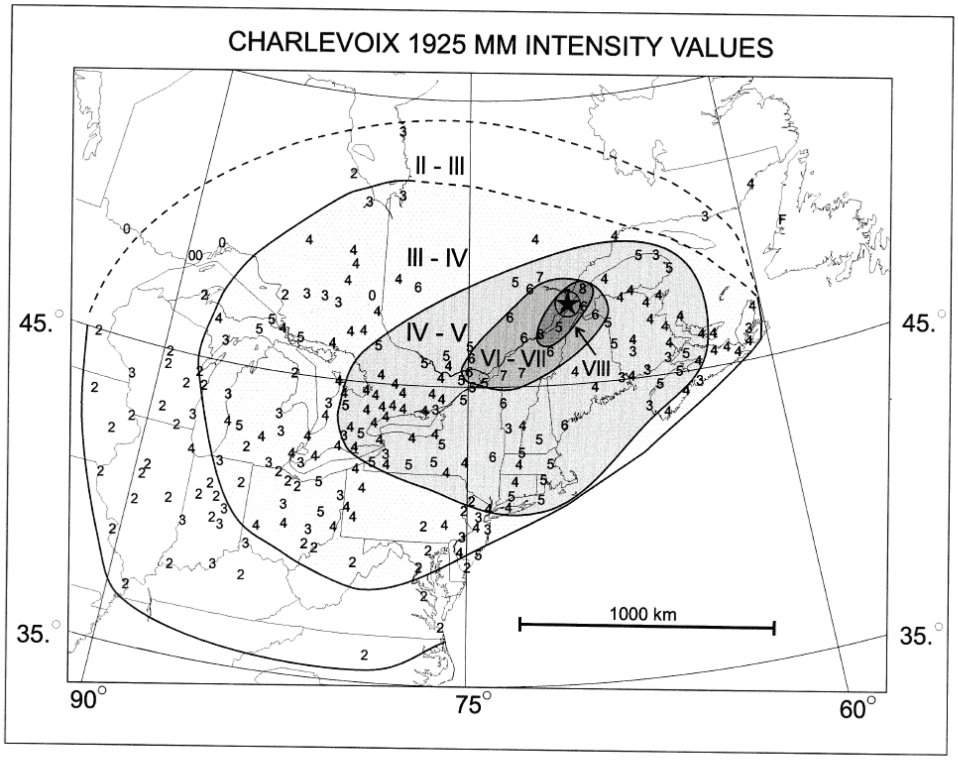

Figure 2. Isoseismal map of the 28 February 1925 Charlevoix earthquake (Cajka, 1999).

The main shock had a maximum intensity of VIII (fallen chimneys and damaged masonry walls) on the Modified Mercalli Intensity scale (MMI; Appendix 1) within the immediate epicentral area. The strongest aftershocks in the month following the main shock were all felt in Charlevoix and Kamouraska. They were recorded by the Ottawa seismograph where their local magnitudes were later rated between 3.7 and 5.0 (the latter corresponds to M_w 4.6; Table 1). As most events were only recorded by one station (Ottawa), all epicentres were assumed the same as that of the main shock (47.8°N, 69.8°W).

Table 1: List of aftershocks recorded on the Ottawa station between March and September 1925 inclusively (Source: Halchuk et al., 2015).

Year	Month	Day (UT)	Hr (UT)	Min	Magnitude (ML)
1925	03	01	02	19	6.2 (Mw) (Main shock)
1925	03	01	04	30	5.0 (4.6 M_W)
1925	03	01	06	25	4.0
1925	03	01	07	25	4.0
1925	03	01	13	21	3.7
1925	03	07	02	30	4.0
1925	03	14	10	18	3.7
1925	03	17	14	45	3.7
1925	03	18	13	15	3.7
1925	03	21	15	22	5.0 (4.6 M_W)
1925	04	10	09	30	3.0
1925	04	11	11	30	3.0
1925	04	26	04	50	3.7
1925	05	31	03	57	3.0
1925	07	06	21	33	3.7
1925	07	27	02	20	3.7
1925	07	27	09	00	3.0

The 1925 earthquake is significant because it is one of five earthquakes of **M** 5.5 or greater in the Charlevoix area since 1663 and one of the strongest in eastern Canada in the 20th century. It was the first major earthquake in Canada to be recorded by seismographs worldwide. It also confirmed that unreinforced masonry (URM) buildings are more susceptible to damage, especially in areas underlain by unconsolidated deposits.

This Open File Report documents all felt and damage information related to this earthquake in Canada and in the United States. For each locality, we include the felt information rated on the MMI scale tabulated in a Microsoft Excel sheet. The Open File also provides a GoogleEarth kmz file that allows the felt information reports to be viewed in this geospatial tool.

The main objectives of this Open File are:

1) To centralize in a table the felt reports and interpreted intensities on the MMI scale for that earthquake.
2) To provide scans of the available original newspapers that included felt reports and damage accounts.
3) To provide a map that shows the distribution of macroseismic reports for that earthquake.
4) To provide some photographs of damage due to that earthquake. The complete set of photographs taken by E.A. Hodgson in the field can be found in Lamontagne (2020)

Improvements and updates from Cajka (1999)

This OF builds on a previous GSC OF Report by Cajka (1999) but it adds more complete and detailed information. Cajka (1999) documents the source of felt reports, the method of interpretation and provides the data in the appendices. A computer-based repository derived from that study contains additional information such as the corresponding intensities on the Rossi-Forel scale (RF) and references to entries that remain enigmatic…

In this OF, the authors aimed to provide a complete picture of this very important earthquake by gathering as many original documents related to the earthquake. Our goal is to centralize all available information and interpretations. The centralization of all data associated with the M_w 6.2 Charlevoix earthquake in one location makes will make it highly valuable to seismologists and historians searching for a complete record. Based on the felt reports and the newspaper accounts, the first author re-examined the evidence for the MMIs V to VIII of Cajka (1999). Very few discrepancies between the new interpretation and the original work were found, and for those identified, explanations were added in the spreadsheet. Intensities of IV and lower were not revised unless additional information was found.

The macroseismic information from Canadian and US postmasters was complemented with additional materials from other collaborators and from newspapers. For the Province of New Brunswick, the second author, Dr Ken Burke of the University of New Brunswick, collected and analysed the felt reports and collected newspaper articles related to the earthquake: his original report can be found in the directory "variousdocuments/Burke-2009-NewBrunswick.pdf". In Cajka (1999), only some of the New Brunswick data were included whereas this OF contains all known data.

Newspapers accounts provided some additional descriptions of felt accounts and damage. Many of them had been kept by E.A. Hodgson and collected in the Dominion Observatory scrapbooks (List in Appendix 2; files in directory: /scrapbook; details in Lamontagne and Szadurski, 2020). The newspaper clippings related to the 1925 earthquake, plus many others found in digital archives or in microfilms, have been scanned and included (directory "/Newspapers"). Whenever possible, we transcribed the text from the newspapers into the spreadsheet. This OF also includes more detailed and site-specific macroseismic information that had been already published in two separate reports: Quebec City (Lamontagne, 2007; 2009) and Ottawa (Lamontagne et al., 2008; 2010).

This OF includes more site-specific damage information than what was found in Cajka (1999). Whenever possible, the local damage reports were georeferenced and interpreted on the MMI scale. In a few cases, the geographic coordinates of Cajka (1999) were updated with more precise information. We made a few corrections to the data of Cajka (1999). For example, Figure 4 in her OF shows Saint-Marc church at Shawinigan, not the one at Rivière-Ouelle as was written.

This OF also contains pictures of damage from the earthquake.

In total, approximately 600 communities in Canada and 180 in the United States were assigned an intensity value based on the MMI scale. Appendix 1 provides the details of the MMI scale.

Reported deaths

There were a number of indirect deaths reported in the newspapers. Most appear to have been related to the fright caused by the ground motions. Hodgson (1950) wrote: "4. No deaths occurred which could be attributed directly to the earthquake. Four, or perhaps five, persons died as the result of shock, which was attributed to the earthquake."

> **La Presse, 3 mars 1925:** *La Pérade : "Dans plusieurs familles la frayeur fut telle que les médecins durent être appelés, notamment chez Mmes France Lefebvre et Eug. Bureau. Malheureusement, cette dernière, avait une maladie de cœur prononcée, ne résista pas au choc nerveux ressenti et elle mourut quelques minutes après l'arrivée du prêtre.»*

> **La Patrie, 3 mars 1925** *: «… Une dame Edgar Harvey a également succombé à la frayeur que lui a causée le tremblement de terre.», p76. La Presse, 3 mars 1925: «Mme Hector Harvey est de Saint-Fidèle, comté Charlevoix, et non de Tadoussac.» Note : the name of the person is slightly different in the two reports.*

La Presse 3 mars 1925*;* Quebec City *: «Les secousses sismiques de samedi soir ont causé la mort d'une jeune femme à Québec. Mme Alphonse Auger fut prise d'une telle frayeur qu'elle perdit connaissance. Son état s'améliora dimanche, mais elle succomba dans la journée d'hier.», P62.*

La Patrie, 3 mars 1925*,* Ste. Anne-de-la-Pocatière*:* Possible casualty *: «...On rapporte que la voûte de la chapelle du collège s'est écroulée de même que le clocher de l'église de la paroisse. M. le curé Edouard Martin a été gravement blessé, assure-t-on, et on dit qu'il est en danger de mort.»* Note : The newspaper 'La Patrie' had a tendency to exaggerate reports and this story must be taken with a grain of salt. Even though Hodgson visited the College, Hodgson does not mention this accident.

Data and results

Some damage and felt information were reported by Hodgson (1950). Canadian intensities were originally rated on the Rossi-Forel scale, but Hodgson never published an isoseismal map, possibly due to his disdain of intensity information (Cajka, 1999). Detailed information on the local impact and an isoseismal map were published in Smith (1962). Unfortunately, it appears that Smith wrongly assumed that the Canadian intensities were on the MMI scale and merged them with the US MMIs to create a plot of the isoseismals (Cajka, 1999). More recently, Cajka (1999) interpreted the felt information using the MMI scale and plotted a new isoseismal map. The main source of felt and damage information is the collection of original felt report questionnaires and documents preserved by the seismology group. In the months following the earthquake, approximately 148 of the 220 questionnaires sent to various locations in eastern Canada were returned (Cajka, 1999). The information contained in newspapers and other reports were also used to complete the damage and felt information.

During six field visits between March 1925 and August 1926, the seismologist of the Dominion Observatory, Ernest A. Hodgson (Figure 1), visited the regions surrounding the epicentre. Photographs taken during his field surveys were published in Lamontagne (2020). Surprisingly, it was only in 1950 that Hodgson finally published his report because it was feared that the earthquake would harm investment and tourism.

False reports and exaggerations

Hodgson (1925) dispelled some false information that circulated in the aftermath of the main shock. These false claims include the destruction of the St. Hilarion church (which had no damage) and various fires in Hébertville, St-Félicien (a fire that started before the earthquake occurred), and Ste-Anne-de-la-Pocatière. Concerning the reported collapse of the church at St-Hilarion, it is rather surprising that this false report included so many details about the impact on the local population (noise heard at distance, men working to remove people from debris; Figure 3). Hodgson (1950) also writes that the damage to the church of Baie-St-Paul was grossly exaggerated.

Another false report appeared in the newspaper “La Patrie” about what could be interpreted as a tsunami wave. According to the newspaper, a wave had engulfed the Canadian icebreaker Mikula that was anchored offshore Port-au-Saumon in Charlevoix. A number of elements suggest that the claim is false: 1) No such claim was reported in the newspaper Quebec Daily Telegraph (p. 43 of scrapbook pages) who interviewed the captain and some crewmembers; 2) No wave of any type was reported in the surrounding communities (but this could be due to the damping offered by the ice cover on the St. Lawrence river); 3) The tide gauge at Lévis did not report any anomalous water level change; 4) In its reports of the earthquake, the newspaper “La Patrie” had a tendency to exaggerate and deform facts, such as the destruction of the St-Hilarion church (but this story was also published in other newspapers); Hodgson does not report any eyewitness account of such event.

BIG STONE CHURCH AT ST. HILARION CRUMBLED TO RUIN DURING QUAKE

Magnificent Edifice, Completed Only Two Years Ago, Fell Prey to First Shock--- Lighthouse Also Damaged

MAR 2 1925

DISASTER OCCURRED ON SATURDAY--- TWO OTHER SHOCKS ALSO RECORDED

With a roar and a crash that could be heard for miles around, the Roman Catholic church at St. Hilarion, sixty miles below Quebec on the north shore, collapsed on Saturday night at the time of the earthquake, according to a report received here this forenoon from the Agent of Marine and Fisheries at Cape Salmon, who is also mayor of St. Simeon.

The church, which was built entirely of stone, and only completed about two years ago at considerable expense, was one of the finest to be seen in any of the down river parishes, and the loss will be keenly felt by the village folk for miles around.

Fortunately there was nobody in the church at the time of the collapse, according to the same source of information, as it was at a time when there was no divine services being held. But it had not been long before that when there was a considerable number of worshippers in the sacred edifice. These, it is said, would all certainly have been killed, as the church buckled and crashed to the ground without a moment's warning.

The priests in charge of the parish were also fortunate in that they did not have their living quarters in the church proper, but rather in an adjoining building which, however, was narrowly missed when the larger structure fell.

The noise made by the collapse of the church terrified the inhabitants of the village, and for the remainder of the night there was no sleep for anybody.

At first it was rumored that there were several people inside of the demolished building, but these rumors luckily proved to be without foundation, and until morning volunteer gangs of men worked among the debris, hoping to save articles of value. They were attended by their wives and families, all with tears streaming down their faces when they realized that their beloved house of divine worship had been laid low without a single warning.

Thus the lonely night vigil was kept by these simple-minded people, who only two short years ago had witnessed the fruits of their labor taking definite shape. The parish priest, assisted by scores of his parishioners, were, according to the last information to hand, going about among the debris in attempts to locate and save the Sacred Host and holy vessels from the ruins, but to date have not been successful.

Apart from this catastrophe the same message reports that there were several wooden houses partly demolished, and the residents were forced to take up their living quarters with their more fortunate neighbors. About thirty chimneys were torn from houses and the bricks and cement were hurled to the road below, while many of the villagers narrowly escaped with their lives as the material rained down.

To date it is thought that this is probably the most serious incident to occur down river, and according to information just received, two more serious shocks were recorded there this morning, the latest one occurring at 10.10 o'clock, the villagers living in constant dread of similar shocks with the passing of the hours.

The lighthouse at Cape Salmon, 81 miles down river also came in for its share of damage. The report states that a part of the machinery was wrenched apart, and that the light itself was put out of commission for the time being.

Figure 3: Image of the newspaper Quebec Daily Telegraph of March 2, 1925, that appears to be entirely forged.

The possibility of a tsunami derives entirely from the article in the “La Patrie” newspaper, a paper that has published some questionable accounts of the earthquake. In our view, the newspaper “La Patrie” had a tendency to create sensation. For comparison, on March 2, 1925, the Quebec Daily Telegraph reported on the arrival of the Mikula in Quebec City (see attached images). The Telegraph mentions that the crew of the Mikula felt the earthquake strongly which made them think that they had hit ground. Nowhere is it mentioned that a wave went overboard. The crewmembers seem calm, they talk about the earthquake and it is mentioned that the ice covering the ship came from their previous days on the St. Lawrence River. This is very different from the catastrophic “La Patrie” report that reads:

> « …De plus, il se trouvait au Cap-au-Saumon lorsque le tremblement de terre se produisit et la secousse sur le fleuve, à cet endroit, fut telle que le navire faillit sombrer. La mer s’ouvrit sous la coque du vaisseau pendant que des vagues gigantesques le couvraient tout entier. … »
> Which can be translated as: …”...Moreover, it (the vessel) was at Cap-au-Saumon when the earthquake struck... and the tremor on the river there was such that the ship nearly sank. The sea opened under the ship's hull as gigantic waves covered it... all of it. ...”

The log book of the Captain of the Mikula would have solved the debate once and for all, but it seems that it is lost forever as the Canadian Public Archives do not have it. One thing is certain: one should be careful with the “La Patrie” articles.

For Quebec City, (Lévis), Hodgson (1950; page 400) states specifically that the tide gauge did not show any change.

> "(e) The level of the Saint Lawrence did not change, up or down, at the time of the shock. Each of these results was currently reported. The tide gauge records conclusively prove these reports to be without the slightest foundation."

There is no eyewitness report of waves hitting the shores of the St. Lawrence. Naturally, we cannot rule out that it could be due to the damping effect of the ice, the fact that it was during a winter night when little activity was taking place on the River.

Finally, in the intensity questionnaires, no postmasters residing along the St. Lawrence River mention any large wave or river disturbance on the night of February 28, 1925.

The Table with the Felt Information

A Microsoft Excel spreadsheet contains the basic information on the felt reports. The main source of information for Canada is the MMI ratings of Cajka (1999). They are included as well as the original RF rating, when provided in the original database of Cajka (e.g. RF 2). When a range of MMIs was given by other sources, the highest integer value was selected. The file folders "/Newspapers" and "/Photographs" contain all scanned newspapers and photographs respectively.

The NOAA earthquake intensity database (NOAA, 2020) includes very few Canadian intensities but has all US intensities listed by Cajka (1999). We have included the US data from NOAA in a separate sheet. See Cajka (1999) for details of the origin of these data.

Using the Microsoft Excel spreadsheet, a table was created that includes some 635 Canadian entries (rows). The column definitions are the same as published in Lamontagne and Burke (2018). The rows have different colours for each province and some cells have different colours when a special note is added.

The columns of the Excel sheet are:

1. CEEF: A date and time that could eventually refer to entries in the Canadian Earthquake Epicentre File (CEEF).
2. Date.time (UTC): date and time of the earthquake in Universal Time.
3. Year_event: Year of the event (YYYY) (Universal Time)
4. Month_event Month of the event (MM) (Universal Time)
5. Day_Event: Day of the event (DD) (Universal Time)
6. Hour-Event: Hour of the event (HH) (Universal Time)
7. Minute-Event: Minute of the event (mm) (Universal Time)
8. Second-Event: Second of the event (ss.s) (Universal Time)
9. MMI Location: Community where earthquake was felt
10. Address: Address where the earthquake was felt (if known)
11. Prov/State: Province or State of the community where the earthquake was felt; NB: New Brunswick; NS: Nova Scotia; PE: Prince Edward Island; QC: Quebec; ME: Maine (USA); MA, Massachusetts (USA) and NH: New Hampshire (USA).
12. Country: Canada or the USA
13. Postal/Zip: Postal Code or Zip Code of the community where the earthquake was felt (if known). In this Open File, no attempt was made to populate this field.
14. Latitude (°N): Latitude of the community where the earthquake was felt; taken from the original felt reports or more rarely obtained from GoogleEarth. Some latitude coordinates of Gouin (2001) which were with only one digit, were changed by the first author and documented in the excel file.
15. Longitude (°W): Longitude of the community where the earthquake was felt; taken from the original felt reports or, more rarely, obtained from GoogleEarth. Some longitude coordinates of Gouin (2001) which were with only one digit, were changed by the first author and documented in the

excel file.

16. Epicentral Distance (km): Epicentral distance in km between the earthquake source and the community where the earthquake was felt. The cell calculates the distance using the formula:

    Epicentral Distance (km) = ACOS(COS(RADIANS(90-(lat. site))) *COS(RADIANS(90-(lat. of epicentre))) +SIN(RADIANS(90-(lat. of site))) *SIN(RADIANS(90-(lat. of epicenter))) *COS(RADIANS(Lon of site - (Lon of epicentre)))) *6371

    We used the epicenter of Lamontagne et al. (2017), i.e. Latitude 47.8°N and Longitude 69.8°W as listed in the second sheet of the Excel file.

17. Final Numeric MMI: Based on the felt report, interpreted intensity on the Modified Mercalli Intensity Scale of 1931. Although MMI is defined using Roman numerals, we decided to convert them to Arabic numerals for ease of use.
18. Basis for MMI (English): Aspects of the felt report in English (if available) that were used to rate the MMI (in Arabic numerals).
19. Basis for MMI (French): Aspects of the felt report in French (if available) that were used to rate the MMI (in Arabic numerals).
20. Source of felt report. This field contains information on the origin of the felt or damage report. Intensity questionnaires are referred to by a DAO number plus the page of the pdf. Newspapers are mentioned. Cajka referred to Entry numbers, the origin of which we could not understand.
21. Precision of location (km): In some cases, it is possible to estimate the radius of uncertainty of the location. We did not use this field in this report.
22. Minimum MMI: The minimum value of MMI for a felt report that is interpreted to lie within a range of intensities (e.g.: MMI 3-4; in Arabic numerals).
23. Maximum MMI: The maximum value of MMI for a felt report that is interpreted within a range of intensities (e.g.: MMI 3-4; in Arabic numerals).
24. Interpreter: Author who made the interpretation.

25. Additional notes: Comments of interest on the felt report or its publication.

GoogleEarth file

To ease the consulting of the data and put them in a geographic context, a kml file is added and can be viewed using the GoogleEarth software that can be downloaded at https://www.google.com/earth/ . A static image of the Google Earth display is shown as figures 4 and 5.

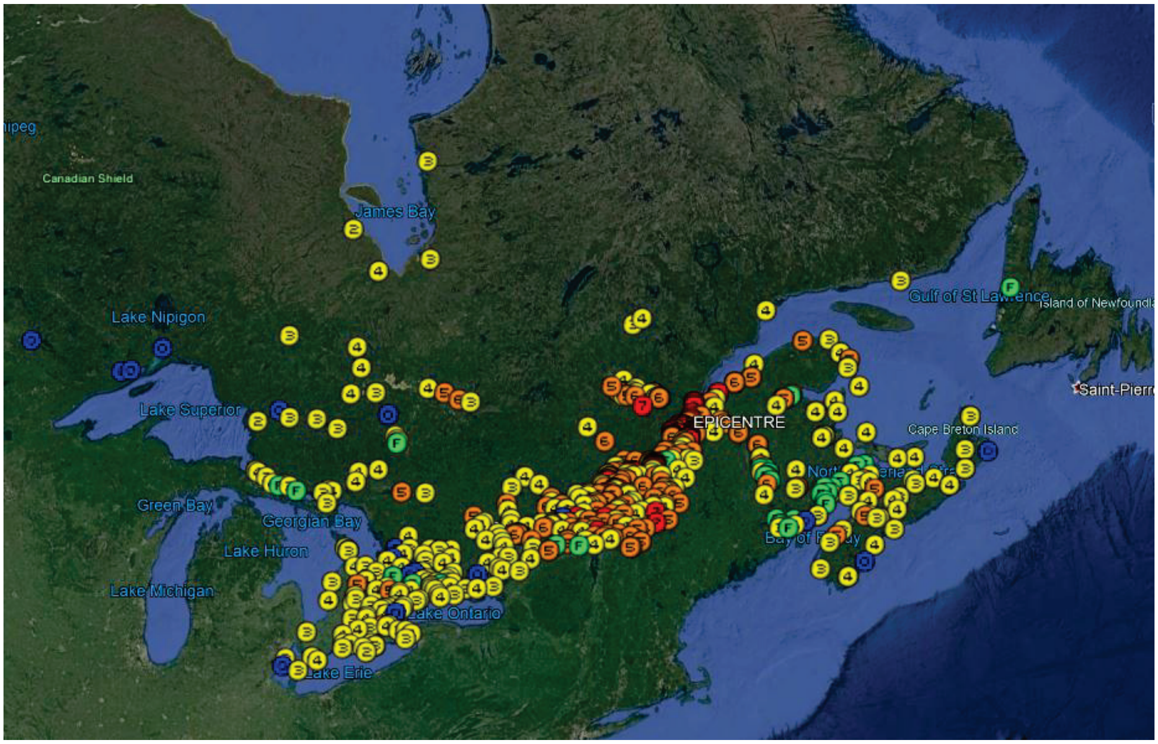

Figure 4. Static image of Google Earth view showing distribution of felt reports included in this OF and generated from the kml file.

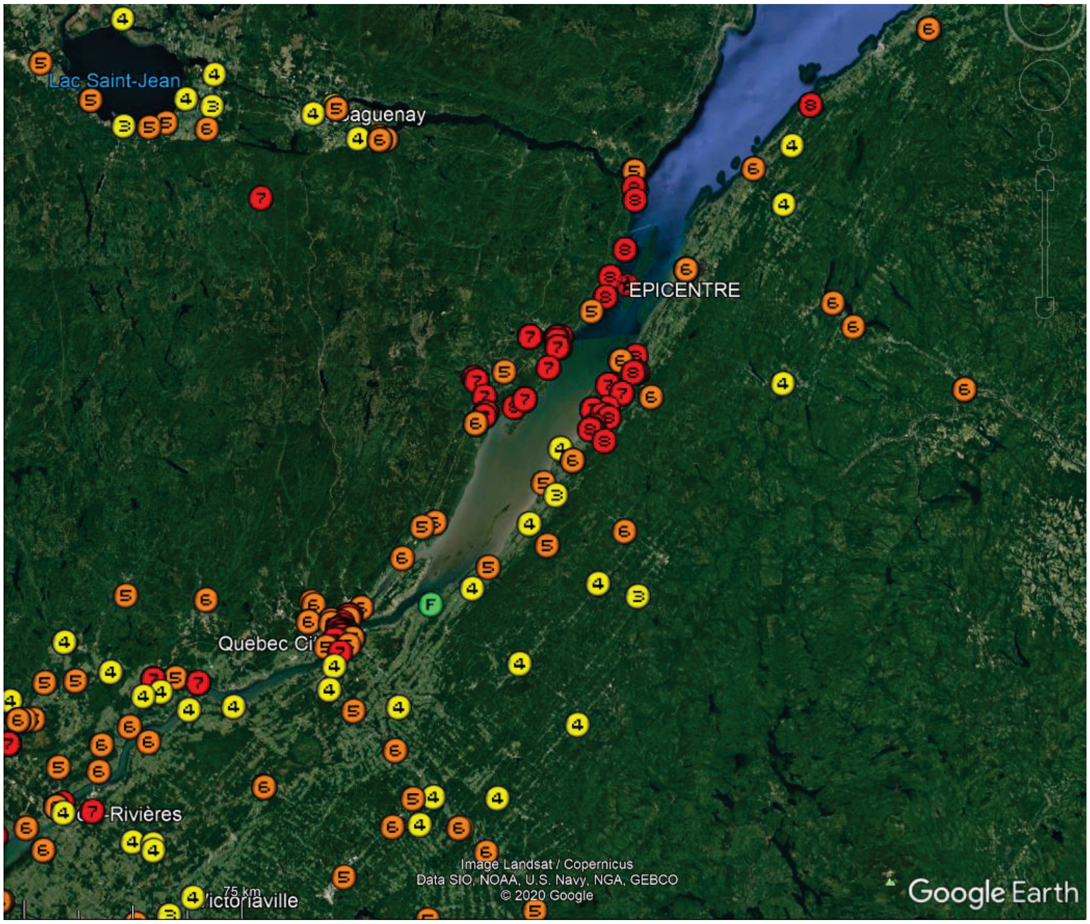

Figure 5. Static image of Google Earth view showing distribution of felt reports in the region surrounding the epicenter included in this OF and generated from the kml file.

Conclusions and recommendations

A new digital repository of felt reports for the 1925 Magnitude 6.2 Charlevoix earthquake was created. We are confident that this Open File includes all available information on how this earthquake was felt. We hope that it will be useful for research on this earthquake as well as on other intraplate earthquakes.

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Appendix 1: Modified Mercalli Intensity Scale (Wood and Neumann, 1931)

I. Not felt -- or, except under especially favorable circumstances.

Under certain conditions, at and outside the boundary of the area in which a great shock is felt:

- sometimes birds, animals, reported uneasy and disturbed;
- sometimes dizziness or nausea experienced;
- sometimes trees, structures, liquids, bodies of water, may sway; doors may swing, very slowly.

II. Felt indoors by few, especially on upper floors, or by sensitive or nervous persons.

Also, as in grade I, but often more noticeably:

- sometimes hanging objects may swing, especially when delicately suspended;
- sometimes trees, structures, liquids, bodies of water, may sway, doors may swing, very slowly;
- sometimes birds, animals, reported uneasy and disturbed;
- sometimes dizziness or nausea experienced.

III. Felt indoors by several, motion usually rapid vibration.

- Sometimes not recognized to be an earthquake at first.
- Duration estimated in some cases.
- Vibration like that due to the passing of light or lightly loaded trucks or heavy trucks some distance away.
- Hanging objects may swing slightly.
- Movements may be appreciable on upper levels of tall structures.
- Rocked standing motor cars slightly.

IV. Felt indoors by many, outdoors by few.

- Awakened few, especially light sleepers.
- Frightened no one, unless apprehensive from previous experience.
- Vibration like that due to the passing of heavy or heavily loaded trucks.

- Sensation like heavy body striking building or falling of heavy objects inside.
- Rattling of dishes, windows, doors; glassware and crockery clink and clash.
- Creaking of walls, frame, especially in the upper range of this grade.
- Hanging objects swung, in numerous instances.
- Slightly disturbed liquids in open vessels. Rocked standing motor cars noticeably.

V. Felt indoors by practically all, outdoors by many or most: outdoors direction estimated.

- Awakened many, or most.
- Frightened few -- slight excitement, a few ran outdoors.
- Buildings trembled throughout.
- Broke dishes, glassware, to some extent.
- Cracked windows -- in some cases, but not generally.
- Overturned vases, small or unstable objects, in many instances, with occasional fall.
- Hanging objects, doors, swing generally or considerably.
- Knocked pictures against walls, or swung them out of place.
- Opened, or closed, doors, shutters, abruptly. Pendulum clocks stopped, started, or ran fast, or slow.
- Moved small objects, furnishings, the latter to slight extent.
- Spilled liquids in small amounts from well-filled open containers.
- Trees, bushes, shaken slightly.

VI. Felt by all, indoors and outdoors.

- Frightened many, excitement general, some alarm, many ran outdoors.
- Awakened all.
- Persons made to move unsteadily.
- Trees, bushes, shaken slightly to moderately.
- Liquid set in strong motion.

- Small bells rang -- church, chapel, school, etc.
- Damage slight in poorly built buildings.
- Fall of plaster in small amount.
- Cracked plaster somewhat, especially fine cracks; chimneys in some instances.
- Broke dishes.
- Fall of knick-knacks, books, pictures.
- Overturned furniture in many instances.
- Moved furnishings of moderately heavy kind.

VII. Frightened all -- general alarm, all ran outdoors.

- Some, or many, found it difficult to stand.
- Noticed by persons driving motor cars.
- Trees and bushes shaken moderately to strongly.
- Waves on ponds, lakes, and running water.
- Water turbid from mud stirred up.
- Incaving to some extent of sand or gravel stream banks.
- Rang large church bells, etc.
- Suspended objects made to quiver.
- Damage negligible in buildings of good design and construction, slight to moderate in well-built ordinary buildings, considerable in poorly built or badly designed buildings, adobe houses, old walls (especially where laid up without mortar), spires, etc.
- Cracked chimneys to considerable extent, walls to some extent.
- Fall of plaster in considerable to large amount, also some stucco.
- Broke numerous windows, furniture to some extent.
- Shook down loosened brickwork and tiles.
- Broke weak chimneys at the roof-line (sometimes damaging roofs).
- Fall of cornices from towers and high buildings.
- Dislodged bricks and stones.

- Overturned heavy furniture, with damage from breaking.
- Damage considerable to concrete irrigation ditches.

VIII. Fright general -- alarm approaches panic.

- Disturbed persons driving motor cars.
- Trees shaken strongly -- branches, trunks, broken off, especially palm trees.
- Ejected sand and mud in small amounts.
- Changes: temporary, permanent; in flow of springs and wells; dry wells renewed flow; in temperature of spring and well waters.
- Damage slight in structures (brick) built especially to withstand earthquakes.
- Considerable in ordinary substantial buildings, partial collapse: racked, tumbled down, wooden houses in some cases; threw out panel walls in frame structures, broke off decayed piling.
- Fall of walls.
- Cracked, broke, solid stone walls seriously.
- Wet ground to some extent, also ground on steep slopes.
- Twisting, fall, of chimneys, columns, monuments, also factory stacks, towers.
- Moved conspicuously, overturned, very heavy furniture.

IX. Panic general.

- Cracked ground conspicuously.
- Damage considerable in (masonry) structures built especially to withstand earthquakes:
- threw out of plumb some wood-frame houses built especially to withstand earthquakes;
- great in substantial (masonry) buildings, some collapse in large part; or wholly shifted frame buildings off foundations, racked frames;
- serious to reservoirs; underground pipes sometimes broken.

X. Cracked ground, especially when loose and wet, up to widths of several inches; fissures up to a yard in width ran parallel to canal and stream banks.

- Landslides considerable from river banks and steep coasts.
- Shifted sand and mud horizontally on beaches and flat land.
- Changed level of water in wells.
- Threw water on banks of canals, lakes, rivers, etc.
- Damage serious to dams, dikes, embankments.
- Severe to well-built wooden structures and bridges, some destroyed.
- Developed dangerous cracks in excellent brick walls.
- Destroyed most masonry and frame structures, also their foundations.
- Bent railroad rails slightly.
- Tore apart, or crushed endwise, pipe lines buried in earth.
- Open cracks and broad wavy folds in cement pavements and asphalt road surfaces.

XI. Disturbances in ground many and widespread, varying with ground material.

- Broad fissures, earth slumps, and land slips in soft, wet ground.
- Ejected water in large amount charged with sand and mud.
- Caused sea-waves ("tidal" waves) of significant magnitude.
- Damage severe to wood-frame structures, especially near shock centers.
- Great to dams, dikes, embankments, often for long distances.
- Few, if any (masonry), structures remained standing.
- Destroyed large well-built bridges by the wrecking of supporting piers, or pillars.
- Affected yielding wooden bridges less.
- Bent railroad rails greatly, and thrust them endwise.
- Put pipe lines buried in earth completely out of service.

XII. Damage total -- practically all works of construction damaged greatly or destroyed.

- Disturbances in ground great and varied, numerous shearing cracks.

- Landslides, falls of rock of significant character, slumping of river banks, etc., numerous and extensive.
- Wrenched loose, tore off, large rock masses.
- Fault slips in firm rock, with notable horizontal and vertical offset displacements.
- Water channels, surface and underground, disturbed and modified greatly.
- Dammed lakes, produced waterfalls, deflected rivers, etc.
- Waves seen on ground surfaces (actually seen, probably, in some cases).
- Distorted lines of sight and level.
- Threw objects upward into the air.

Appendix 2: List of files with the scanned intensity questionnaires

Note: in most cases, there is some alphabetical order by names of municipalities.

DAO-1: Nfld, newspaper clippings
DAO-2: Blank Questionnaires
DAO-3: Dorchester to Durham, including Baie-St-Paul P6
DAO-4: Fenelon Falls to Fort Frances, P2 Farrelton
DAO-5: St-Adalbert to St-Aubert
DAO-6: Ashbury Pk, St-Camille (L'Islet), St-Bruno (LSt-J), St-Casimir, Baie-Ste-Catherine, St-Croix, St-Cyrille-de-L'Islet
DAO-7: Alma to Andover, P1 Halliburton
DAO-8: Baddeck to Brampton
DAO-9: Shawinigan Falls, Caledonia Springs, Calumet, Cobden
DAO-10: Caledonia to Cordova Mines, P15 Les Éboulements (incl. Caraquet, Chapleau,
DAO-11: Garvendale to Guysborough & Hawkesbury P16 and P19, Halliburton PP17-18; PP1-2 Elgin
DAO-12: Hearst to Kinmount, P1 and P3 Hawkesbury, P2 Halliburton
DAO-13: Lachine to Liverpool, P1 Lorneville (incl. Les Éboulements)
DAO-14: Louisbourg
DAO-15: Maitland to Montréal; P3 Beauceville, P6 Flint, P14 Misère
DAO-16: Newboro to Nipigon
DAO-17: Pakenham to Port Severn
DAO-18: Richibucto and Roberval
DAO-19: Sayabec to Springhill,NS
DAO-20: St-Donat-de-Rimouski to St-Gabriel-de-Brandon
DAO-21: St-Gabriel-de-Brandon to St-Jean-Port-Joli
DAO-22: St-Jules-de-Beauce to Swastika
DAO-23: Tadoussac to Windigo