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Earthquake of February 10, 1914

BY

OTTO KLOTZ, LL.D., F.R.A.S.

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EARTHQUAKE OF FEBRUARY 10, 1914.

BY OTTO KLOTZ, LL.D., F.R.A.S.

About half-past one in the afternoon of February 10, 1914, a pretty severe earthquake shock was felt in Ottawa, though not by everyone. Persons travelling in the street cars and many engaged in factories were unaware of the disturbance. The whole observatory staff felt the shock or shocks (two) distinctly; it created some excitement. Occurring during our luncheon hour, I was reading at the time, facing the north in my room. When the first impulse arrived, I looked up at the electric clock—it stood at $1^h\ 31^m$—and from the first sound or noise I thought that some of the desks in the large room overhead were being rolled across the floor. But presently the noise grew louder and stronger, and I noticed a trembling of my book-cases, showing that the disturbance was due to an earthquake. The photographic sheet containing the record of the two horizontal seismographs was taken off and developed, and the vertical component was well shown on the smoked paper. Naturally, immediately following the shock the Observatory was deluged with telephone calls, not only from the city, but also from neighbouring places, and from the Press in Montreal. They continued for fully three hours. Perhaps the scientist should consider it a compliment that when a phenomenon takes place, such as an earthquake, that the next moment the public calls upon him, clamours for an answer to: Where did it happen? Why did it happen? How deep down was it? Did you know it was coming? Can you foretell earthquakes? Such were some of the questions that poured into the Observatory. Before the paper was dry after developing, we were able to answer as to the distance of the epicentre from Ottawa, and its probable direction.

We felt safe in saying that the distance was 120 km., or about 75 miles, and the direction northeasterly from Ottawa in the Laurentian hills. As to the depth, that required a little more time for consideration and possible determination. The evening papers and those of the following

morning from many places showed that the quake had been felt over a very wide area. In consequence, many of our blank earthquake-forms were sent out to postmasters from Rimouski to Philadelphia, and from Sault Ste. Marie to New York for reply to the various printed questions. These replies, together with newspaper reports were compiled, sifted, and alphabetically arranged as seen in the subjoined table. As usual, gross exaggerations were encountered, not as bad as those of the great quake of 1663, yet bad enough. As an example, we quote the following from a Buffalo paper: "In parliament building at Ottawa, pictures were shaken from the walls, tables and desks were overturned, and the buildings rocked on their foundations. Telephone poles were shaken down on the outskirts of the city and telephone communication to some extent was interrupted. Residents of the outskirts were panic-stricken and fled from their homes into the open fields. Members of parliament left their desks and ran bareheaded into the streets." There was practically not a word of truth in this statement, but it no doubt made interesting reading for the public at the time, and the public craves for things exciting. Imagine an earthquake overturning a desk resting on its base or four legs; why, the motion necessary to do that would raze every building in the city.

The places where the earthquake was felt, as tabulated hereunder, were entered on a map in order to give a bird's-eye view of the area disturbed, which was found to cover nearly 200,000 square miles (fully 500,000 sq. km.), an area about eight times as large as that affected by the local quake of April 28, 1913, of which a monograph was issued, as Publication No. 5, Vol. 1, of the Dominion Observatory. The most westerly point in the Ontario peninsula at which the quake was felt was at St. Thomas, corresponding to Ashtabula, nearly due south, on the south shore of lake Erie, which marked the westerly limit on the lake. Philadelphia was the most southerly place, and Chicoutimi the most easterly, as well as the most northerly place, to feel the shock. To the northwest we have reports both from North Bay and from White River, but in each case the informant is not certain of the cause of what was felt at approximately the time of the quake, as some blasting was going on at the time there.

Comparing the distribution of the places where the quake was felt with the geologic map accompanying the "Index to the Stratigraphy of North America," by Bailey Willis, there is no very apparent relation

between the surface geology and such distribution. We find formations affected from his 15, the Devonian, to 24, Pre-Cambrian Intrusives. It may be noted that the extremes to the north and south are respectively Chicoutimi and Philadelphia, and each is shown as on or near the edge of 24, Pre-Cambrian Intrusives, so are St. Jérôme and Saranac Lake within that designation. The general observation might probably with justice be made that relatively more places reported from areas classified as "Laurentian" or "Pre-Cambrian" than from sedimentary formations. As the hypocentre or hearth of the quake was pretty deep below the surface, as we shall show later, it is to be expected that the vibrations would be more readily and effectively transmitted through the archæan and intrusive rocks than through various sedimentary formations overlying one another. The intensity of the shock as described at different places was not sufficiently definite or accurate that isoseists could be drawn. The intensity does not appear to have been directly related to or a function of the distance from the epicentre. Believing the determination of the distance to the epicentre from the Ottawa seismograms to be correct within narrow limits, say 10 or 15 kilometres, and the direction also, one is at a loss to explain satisfactorily why the effect of the quake was not greater in and about the epicentre, and why, again, the effect if weak in the epicentre was so widespread. This anomaly has been noted elsewhere. In the article "Zur Erklärung der geographischen Verteilung von Grossbeben," by Rudolph and Szirtes in the March number of Petermann's Mitteilungen, we read, p. 130, that it has been found that a large number of the destructive earthquakes are not even registered or recorded at any considerable distance from the epicentre. As an instance, the destructive quake of July 8, 1911, in Hungary is quoted, which was scarcely recognizable on seismograms 200 km. distant. Again, in the case of the quake of November 16, 1911, in southern Germany, the area in which it was instrumentally recorded is not much larger than the area in which it was felt. On the other hand, for a similarly large number of quakes, the epicentral disturbance may be comparatively small, yet the quake may be registered over the whole or greater part of the globe. This latter statement is somewhat in line with the further phenomenon referred to by Quervain in his "Die Erdbeben der Schweiz im Jahre, 1912," p. 2, wherein he points out, referring to the local Swiss quake of March 31, 1912, that the area within which the earthquake was actually felt was extraordinarily large, considering the intensity at the supposed epicentre.

This last is thoroughly in keeping with our experience of the local quake of February 10 last. As a plausible explanation of these phenomena, the depth of the hypocentre may be considered.

Obviously the greater the depth of the hearth, the greater relatively will be the extent of country shaken, the quake has got in that case a good grip on the earth, and the differences of intensity on the surface will be less than for more shallow quakes, that is, the gradients of the isoseists will be longer in the former than in the latter case. Furthermore, the nature of the rupture, whether vertical or horizontal, or in an oblique direction to the surface, would be manifested in the dimensions of the disturbed area. The available instrumental records of the quake are so very few that the latter consideration cannot be examined for a definite answer, and we are practically confined to the consideration of our own record.

In line with our experience we may refer to the Californian quake of April 24, 1914, where the instrumental record at Berkeley pointed to a quake of considerable intensity, but no place so reported. E. F. Davies, in "University of California Publications," p. 168, says of it: "The wide area over which this earthquake was felt, together with the fact that no very high degree of intensity was reported at any point, seems to indicate that it was an earthquake whose depth of origin was greater than is usual for the ordinary earthquakes of this region."

The following are the records of Ottawa and Harvard:—

Ottawa.						Harvard.			
Component.	Phase.	Time.	Period.	Amplitude.	Distance.	Phase.	Time.	Period.	Distance.
		h. m. s.	s.	μ	km.		h. m. s.	s.	km.
N	*P*	18 30 59·5	0·5	20	120	eP_N	18 32 03	0·4	435
E	*P*	18 30 59·5	0·5	15		eP_E	18 32 04	0·4	
N	*MP*	18 31 03·8		38		SL_N	18 32 51	16·0	
E	*MP*	18 31 03·8		28			18 33 07	6·0	
N	*S*	18 31 11·8				SL_E	18 32 51	8·0	
E	*S*	18 31 13·0					18 33 07		
	F	18 40				*F*	18 40		
V	*P*	18 31 00·0	0·5	20					
V	*S*	18 31 12·3	1·0						
V	*M*	18 31 13·7	1·0	110					
	F	18 38							

From the Ottawa record, on which for the three components the *P* and *S* phases can be read with accuracy, it is believed that the distance, 120 km., is correct within narrow limits. The reading of amplitudes on the seismogram, and applying the proper magnification is not so easy or reliable as reading the time-scale. On the former depend the azimuth and the depth, while on the latter depends the distance. From the amplitudes 20 and 15 respectively for the north and east components, we obtain from the simple trigonometrical relation, the azimuth N 37° E, to the nearest degree. The epicentre is therefore in latitude 46° 15′ N, and longitude 74° 46′ W.

The depth of the hearth or hypocentre is next to be considered. Difficulties, theoretical and instrumental, have so far been of such a nature and magnitude, that the problem still awaits a satisfactory solution. The question has occupied a number of able investigators; various formulæ have been devised—some simple, others more involved—all made under certain assumptions, none of which has stood the test of actual conditions, so that at the moment the uncertainty of a determination of the depth of the hearth is a large fraction of the depth itself. From the two horizontal components and the vertical one we obtain the direction of the emerged seismic ray, that is, of the tangent to the circular path of the ray which passes through the hypocentre and station. For our quake we find the angle of emergence to have been 38° 40′. We may attack the problem in the following manner, using as argument the above angle of emergence. There are various tables giving the theoretical angle of emergence for seismic rays covering arcual distances with 500 km. intervals. Among them we may refer to the one in Galitzin's "Seismometrie," p. 118. Interpolating from this table for emergence angle 38° 40′, we find the corresponding distance, Δ, to be 2,100 km. As our quake gives an angle of emergence of 38° 40′, we reason that the hypocentre must lie somewhere on the path of a seismic ray of 2,100 km. arcual distance. On this assumption we have the following data for computing the depth of the hearth or hypocentre:—

Distance of epicentre from Ottawa 120 km., arc 1° 04′·8; angle of emergence 38° 40′; its complement 51° 20′; above distance, Δ, 2,100 km.; chord 2,090 km.; arc 18° 54′; angle of chord with horizon 9° 27′; deduced radius of seismic ray 2,140 km.; and deduced distance from centre of earth to centre of seismic ray 8,152 km. From the above data we readily compute

the length of the radius vector at the hypocentre and find it to be 6,285 km., the radius of the earth having been taken at 6,370. Hence we have for the depth of the hypocentre, the difference of the two quantities, or 85 km.

In the distance, 120 km., of the epicentre from Ottawa there can be but a very small margin of error; though the direction may be in error a few degrees, the immediate epicentral area is fairly confined within narrow limits. The depth, 85 km., of the hypocentre at first sight seems great. However, the writer believes, with considerable confidence, that it was not less than this. The earth movement as described by residents at Labelle and Nominingue, small hamlets situated near the determined epicentre, was not much more severe than at Ottawa. This affords an indication that the depth was a large fraction of the distance, 147 km., of the hypocentre from Ottawa.

We find that the epicentre as determined falls in the vast area marked 23, Laurentian, of the above geologic map; in an area beneath which there are no sedimentary formations, and we cannot speak here of newer formations settling and adjusting themselves as the cause of the quake; nor is there any evidence of any fault line in the vicinity along which the adjustment of the stresses took place, as is so common in earthquakes. The great St. Lawrence-Champlain fault line is not marked by any pronounced movement, as would be the case if along that line of weakness the adjustment had taken place. An earthquake is a manifestation of adjustment towards equilibrium of the stresses prevailing in that area or part of the earth's crust. In our local quake of the preceding year, the epicentre fell within an area of the Cambro-Silurian period, in which the Calciferous and Trenton predominate, affording us a more plausible explanation of the quake than we are able to offer in the present case. Also in the quake of 1913 we had very pronounced differences of effect, due to varying proximity to the epicentre, which shows that this quake was far shallower than that of February 10 last, which moreover at the computed depth of 85 km. was far below any recognized geological formation, and at two-thirds or more of the theoretical depth of isostatic compensation.

It is gratifying that the number of earthquake stations with recording instruments on this continent is steadily increasing, so that local quakes, such as the one of February last, will have less chance of escaping analysis.

The accompanying table has already been referred to. The copy of the record of the vertical seismograph and the map covering the area affected by the quake are self-explanatory.

RECORD OF PLACES WHERE EARTHQUAKE WAS FELT.

Station.	Duration.	Number of Shocks.	Nature of Shock.	Effect.	Sound.	Ground.
Actonvale, Que.	Few secs.	1	.....	Windows rattled.	.....	No rock.
Albany, N.Y.	20 secs.	2	Jerks.	Desks, tables, and electric lighting fixtures moved.	No noise.	Clay and loam.
Ashtabula, Ohio.	3 mins.	1	Tremble.	.....	Rumbling.	.....
Auburn, N.Y.	About 15 s.	1 small, 1 heavy.	.....	.....	.....	.....
Batiscan, Que.	1 min.	1	Wave.	Articles on shelves shook.	No noise.	Sandy loam.
Bédard, Que.	1 to 2 mins.	1	Wave.	.....	Like freight train.	Rock
Belleville, Ont.	About 1 m.	1	Wave.	Hand-bag hanging on post had swinging motion.	No noise.	Clay soil.
Berlin, Ont.	15 secs.	1	Wave.	.....	.....	Sand, no rock exposure.
Berthier en haut, Que.	14 or 15 secs.	2	Wave.	.....	No noise.	No rock.
Binghamton, N.Y.	Few secs.	1	Slight vibrat'ns.	No effects, save vibrations.	Not noticed.	River valley rock bed.
Brantford, Ont.	5 secs.	1	Lateral movement.	Draughting desk shook	No noise.	Gravel, no rock exposure.
Brockville, Ont.	About 1 m.	1	Wave.	Everything in house shook, plaster on S. side cracked.	.....	Rocky surface.
Buckingham, Que.	20 secs.	1	.....	Windows rattled.	No noise.	Rocky.
Buffalo, N.Y.	.....	.....	.....	Slight shock.	.....	.....
Burlington, Vt.	30 secs.	2	Jerks.	Dishes and windows rattled, chandeliers and curtains moved.	.....	Rocky foundation.
Cambridge, Mass.	.....	.....	.....	Collection case doors swing open.	.....	.....
Canton, N.Y.	10 secs.	1	Wave.	A slight rattling.	Rumbling.	Gneiss.
Carleton Place, Ont.	10 secs.	1	Wave.	Windows rattled a little.	Like rumble of passing train	Rock exposed in some places.
Castleton, Vermont.	30 secs.	.....	.....	Felt mostly in north end of town.	.....	.....
Catskill, N.Y.	2 secs.	1	Wave.	Windows rattled.	No noise.	Clay hills.
Chalk River, Ont.	Several secs	.....	.....	.....	.....	Sandy loam.
Chelsea, Que.	30 secs.	1	A shaking motion.	Crockery rattled in sideboard.	As if high wind had started to blow.	Clay.

RECORD OF PLACES WHERE EARTHQUAKE WAS FELT—*Continued.*

Station.	Duration.	Number of Shocks.	Nature of Shock.	Effect.	Sound.	Ground.
Chicoutimi, Que.	About 30 s.			Light shock only.		
Cohoes, N.Y.		2		Shock distinctly felt.		
Cooperstown, N.Y.	About 1 m.			Buildings shaken.		
Cornwall, Ont.	About 45 s.		Like an explosion.	Windows rattled, plaster fell.	Like an explosion.	Clay, sandy foundation.
Drummondville, Que.	40 secs.	2 1 small.	Wave.	Windows and doors rattled.	Rumbling.	Rock.
Danville, Que.				Shock distinctly felt.		
Duhamel, Que.	1 min.		Wave-motion.	Shock passed from N. to S., house cracked on N. side.	Rumbling.	Rocky.
East Hereford, Que.	15 to 20 s.	1	Wave.		No noise.	Mountainous.
Eganville, Ont.	2 mins.			Windows rattled.		Loam and stony.
Elmira, N.Y.				Very perceptible tremors felt.		
Farrellton, Que.	2 mins.			Everything shook, nothing fell.	Sounded like a train coming.	Mountainous.
Fort Edward, N.Y.	About 30 s.			Shock distinctly felt.		
Fort Plain, N.Y.				Very perceptible tremors felt.		
Fredonia, N.Y.				Houses were observed to shake.		
Galt, Ont.				Slight disturbance noticed by patients in hospital.		
Gananoque, Ont.	Sev'l secs.			Shock more severe in stone buildings. Clock started that was formerly stop'd.	Like something heavy rolling on roof.	
Glens Falls, N.Y.	2½ mins.	1		Windows rattled.	Like ice sliding off the roof.	
Gloversville, N.Y.				Pictures hanging on walls began to swing.		
Gracefield, Que.	1 min.	1	Wave.	Windows rattled.	Rumbling.	Clay.
Grand Mère, Que.	30 secs.	1	Wave.			Rocks.
Guelph, Ont.				Very slight shock felt?		
Hamilton, Ont.				Distinct lateral shock felt.		
Hartford, Conn.				Dishes rattled, doors slammed.		
Hudson Falls, N.Y.	About 30 s.			Shock distinctly felt.		
Ithaca, N.Y.	40 secs.			Keys hanging on board rattled.		Rock.
Jamestown, N.Y.		2		Shaking disturbed pendulum of clock from its course.		
Joe Lake (Algonquin Park), Ont.	10 mins.?			Stove rattled.	Like a train in motion.	Sand and rock.

RECORD OF PLACES WHERE EARTHQUAKE WAS FELT—*Continued.*

Station.	Duration.	Number of Shocks.	Nature of Shock.	Effect.	Sound.	Ground.
Joliette, Que.	30 secs.	1	Wave.	Windows rattled.	Like noise of waggon over frozen road.	Rocky.
Kemptville, Ont.	1 min.	1	Wave.	Windows rattled, bell rang which was hanging on line.	Slight.	Gravel and clay.
Kingston, N.Y.				Slight tremor felt.		
Kingston, Ont.	About 20 s.	2	Distinct vibration.	Rattling in chimney.	Like rumbling of heavily loaded waggon.	Clay and rock.
Labelle, Que.	About 30 s.	1	From jerk to wave.			Rocks.
Lake George, N.Y.	About 30 s.			County buildings shook.		
Lanark, Ont.	20 secs.	1	Wave.	Cooking utensils on wall rattled.	Like heavy truck passing.	Rock foundation.
Limoilou, near Quebec city.				Slight tremors felt.		
Lindsay, Ont.	2 mins.	2	Steady trembling.	Furniture shook.	Rumbling.	No rock.
Longueuil, Que.	10 secs.	1	Wave.	Windows rattled.		
Loudonville, near Albany, N.Y.				Shock quite noticeable	Like heavy motor truck passing.	
Louiseville, Que.	1 min.	1	Wave.		Like a gust of wind.	No rock.
Malone, N.Y.				Distinct tremors felt.		
Maniwaki, Que.	15 to 30 s.	1	Wave.	House and furniture shook.	Sounded like a loaded waggon passing.	Mountainous
Meaford, Ont.	2 to 3 mins.			Pictures hanging on walls, and foliage noticeably affected.		
Millbrook, Ont.				Slight tremor felt.		
Montebello, Que.	25 to 30 s.	1	Wave.		Like train passing near the house.	Rocky.
Montreal, Que.	2 mins.	1	Jerky.	Windows rattled.		Rocky.
Morrisburg, Ont.	30 secs.	1	Wave.			No rock.
Mount Royal Tunnel, (Montreal), Que.				People living in vicinity of tunnel thought tunnel had collapsed		
Napierville, Que.	1 min.	1	Wave.		Slight noise.	No rock.
New Haven, Conn.				Tremors quite perceptible.		
New York, N.Y.	15 to 30 s.	1				
Nominingue, Que.	37 secs.	3	Wave and jerk.	Windows rattled.	Like thunder.	Rocks.
North Bay, Ont.			Jerk.	Steam water pipes rattled.		Rock.
Northfield, Vermont.	1 min. 15 secs.	2	Wave.	Doors of office cabinet rattled.	No noise.	Glacial sand, probably on bed rock.

RECORD OF PLACES WHERE EARTHQUAKE WAS FELT—*Continued.*

Station.	Duration.	Number of Shocks.	Nature of Shock.	Effect.	Sound.	Ground.
Norwood, Ont.	About 1 m.	Several shocks.		Dishes rattled and pictures shook.	A deep rumbling.	
Ogdensburg, N.Y.				Slight shock felt.		
Ormstown, Que.	Over 1 min.	1		Violent shaking, crockery rattled.	No noise.	Clay, no rock.
Oswego, N.Y.	30 secs.	1	Wave-motion.	Windows rattled.	No noise.	Sandy loam.
Ottawa, Ont.	2 secs.		Jerk.	Windows rattled.	No noise.	
Owen Sound, Ont.	40 secs.	1	Jerk.	Electric fixtures and flowers in room shook.		
Parry Sound, Ont.	10 to 20 s.	1	A steady vibration.	No damage, shock felt all over house.		Rock surface.
Pembroke, Ont.		1	Trembling motion.	Bottles shook.	Heavy rumbling	Clay surface, rock foundation.
Peterboro, Ont.	8 to 10 s.		Wave-motion.	Plaster cracked on all four sides of building.	As though some heavy object were being rolled on floor	Rock foundation.
Philadelphia, Pa.				Distinct shock felt.		
Plainfield, N.J.				Tremor plainly felt.		
Port Hope, Ont.				Quite a distinct shock felt,no damage done.		
Potsdam, N.Y.	1 min.	2 1 small.	Continued irregular shaking.	Statue which was cracked broke into pieces.	Rumbling rolling.	
Prescott, Ont.	40 secs.	1 distinct 5 light.	1 jerk and several waves.	Windows rattled.	Low rumbling	Rock.
Quyon, Que.	About 30 s.	1	Jerky.	Windows rattled.	Rumbling.	Rock.
Renfrew, Ont.	2 mins.	1	Wave.	Dishes rattled.	No noise.	Clay.
Rigaud, Que.	15 secs.	1	Wave.	Electric lamp moved.		Clay.
Rochester, N.Y.	Very few secs.	1	Wave-motion.			Rock.
Rome, N.Y.				No damage done, shock distinctly felt.		
Saranac Lake, N.Y.	3 or 4 secs.	1 strong, 2 small.	Fundamental rocking.	Windows rattled, pictures rocked against walls.	Noise of house vibrations.	Rock.
Saratoga, N.Y.	7 or 8 secs.			No damage done.		
Schenectady, N.Y.				Shock distinctly felt.		
Scranton, Pa.				Shock felt slightly.		
Sharbot Lake, Ont.	About 15 s.	1	Wave-motion.	Rattling.		Rock.
Skaneateles, N.Y.				Shock disturbed type in print-shop.		
Slingerlands, near Albany, N.Y.				Shock very slight.		
Sorel, Que.	30 secs. at least.	2	Jerky.	Two lids of the stove were thrown out of place, and shaken back into their original position.	Rumbling noise.	No rock.

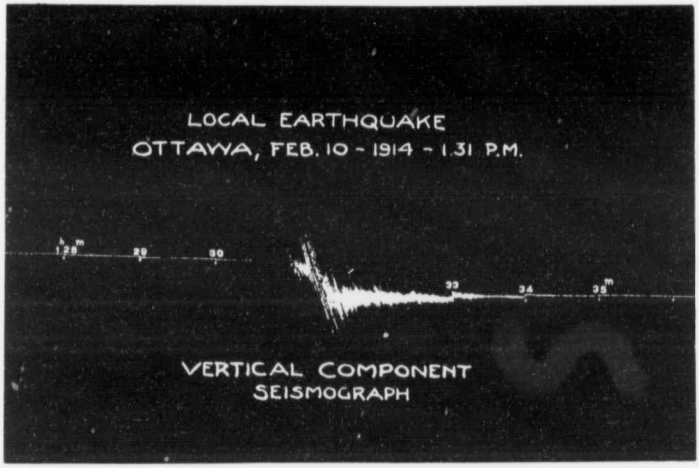
RECORD OF PLACES WHERE EARTHQUAKE WAS FELT—*Concluded.*

Station.	Duration.	Number of Shocks.	Nature of Shock.	Effect.	Sound.	Ground.
Springfield, Mass.				Distinct shock felt. Buildings rocked from E. to W.		
Ste. Agathe des Monts, Que.	1 min. 30 secs.		Wave.		Rumbling.	Mountainous
Ste. Madeleine, Que.				Distinct shock felt.	Dull rumbling noise.	
Ste. Thérèse, Que.	25 to 30 s.		Wave.		Like the rolling of a waggon.	No rocks.
St. Catharines, Ont.				Billiard balls rolled around tables.		
St. Charles, Que.				Severe shock felt.		
St. Jean, Que.	About 5 s.	1	Jerk.	Dishes rattled.		No rock.
St. Jérôme, Que.	1 min.	1	Succession of jerks.	Windows rattled.	Loud rumblings	Rock.
Stratford, Ont.	1 sec.	1	Wave-motion.	Vibration of house.		Gravel bottom.
St. Thomas, Ont.				Only slight shock felt.		
Syracuse, N.Y.	1 sec.	1	Wave.	Swaying of chandelier.	Dull jar, like some heavy object falling.	Glacial tills, overlying Silurian shales.
Three Rivers, Que.	20 to 30 s.	2	Wave-motion.		No noise.	No rock.
Toronto, Ont.		2	Wave.	Windows rattled.	Like the tearing of paper.	
Troy, N.Y.	10 secs.	2		Seemed to come from N. to S.		
Tunkhannock, Pa.				Distinct shock felt.		
Utica, N.Y.	15 secs.	1	Wave-motion.	Windows rattled.	Like heavy wagon passing.	Rock.
Vankleek Hill, Ont.				Quite a severe shock felt.		
Verdun, near Montreal, Que.				People ran out of their houses.	Like passing of heavy motor truck.	
Voorheesville, near Albany, N.Y.				Shock very slight.		
Wakefield, Que.	1 to 2 mins.	1		No damage done.	Loud rumbling noise.	Clay loam.
Watertown, N.Y.	20 secs.	1 slight, then 1 heavy	Wave-motion.	Windows rattled.	Low rumbling.	Hilly, rock exposures.
Westmount, adjoining Montreal, Que.				Felt as though someone on the floor above were jumping up and down, shaking the building.		
White River, Ont.	1 or 2 secs.			Slight shock felt.		
Woodstock, Ont.				Clock stopped, bookcase shook.	As though verandah were being torn loose from house.	No rock.
Worcester, Mass.				Distinct shock felt.		

These places were heard from, but no shock was noticed at them:—

Arthabaska, Que.; Cartier, Ont.; Chatham, Ont.; Cleveland, Ohio; Collingwood, Ont.; Erie, Pa.; Father Point, Que.; Goderich, Ont.; Granby, Que.; Harrisburg, Pa.; Kincardine, Ont.; Levis, Que.; L'Islet, Que.; London, Ont.; Montmagny, Que.; Mount Forest, Ont.; Olean, N.Y.; Oshawa, Ont.; Pittsburg, Pa.; Port Rowan, Ont.; Preston, Ont.; Quebec, Que.; Richmond, Que.; Roberval, Que.; Sarnia, Ont.; Sault Ste. Marie, Ont.; Scotia Jct., Ont.; St. Frederic, Que.; St. Marys, Ont.; White River Jct., Vt.; Windsor, Ont.

Dominion Observatory,
Ottawa,
July, 1914.


LOCAL EARTHQUAKE
OTTAWA, FEB. 10 - 1914 - 1.31 P.M.
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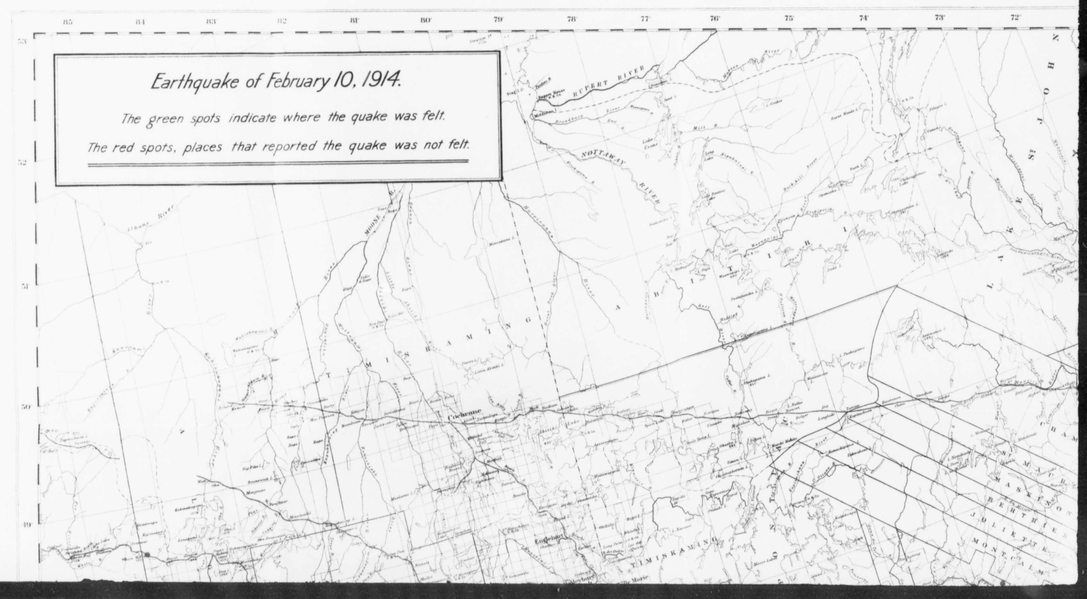
VERTICAL COMPONENT
SEISMOGRAPH

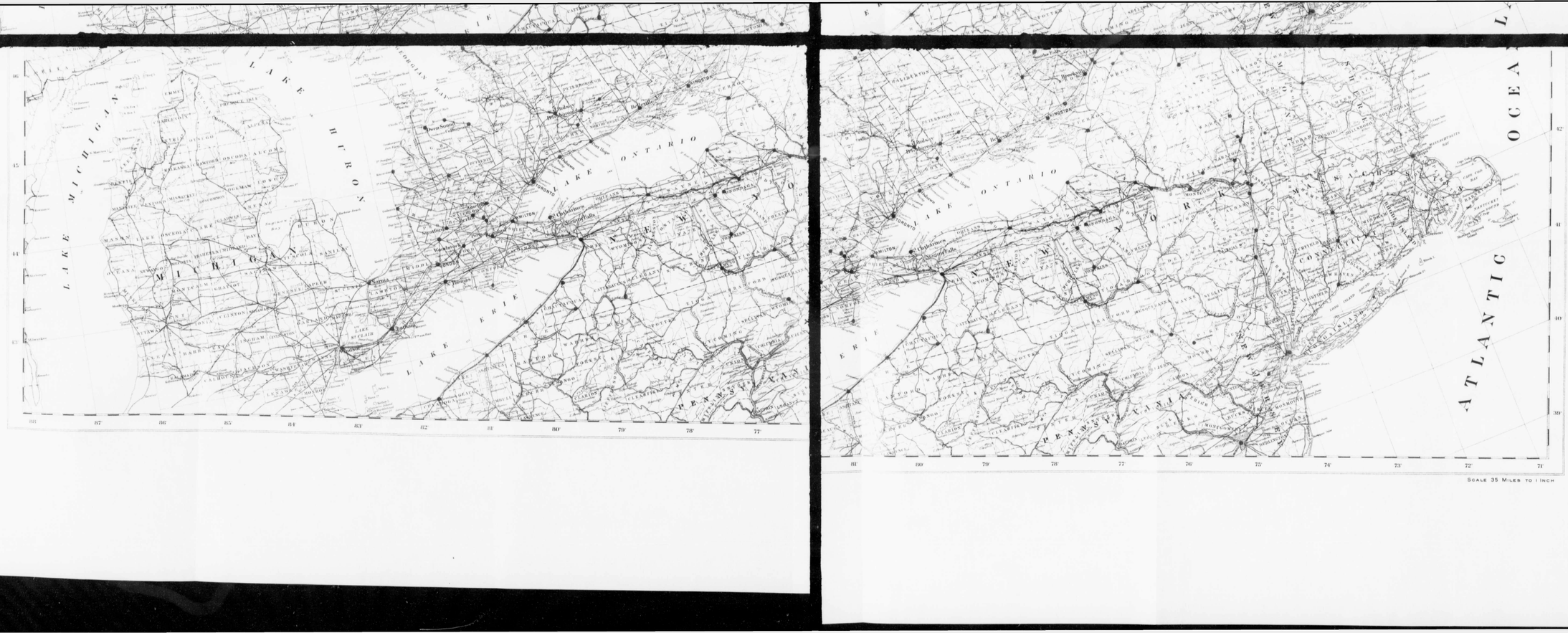
Publications of the Dominion Observatory, Vol. III, Nº 1.



Earthquake of February 10, 1914.

The green spots indicate where the quake was felt.

The red spots, places that reported the quake was not felt.


LAKE MICHIGAN
LAKE HURON
LAKE ONTARIO
LAKE ERIE
MICHIGAN
NEW YORK
PENNSYLVANIA
ATLANTIC OCEAN
Toronto
Hamilton
Niagara Falls
Buffalo
Rochester
Syracuse
Albany
Boston
Detroit
Port Huron
Sarnia
Cleveland
Erie
Scale 35 Miles to 1 Inch