SECTION V.—SEISMOLOGY.

SEISMOLOGICAL ABBREVIATIONS USED IN THE INSTRUMENTAL REPORTS.

CHARACTER OF THE EARTHQUAKE.

I=noticeable.
II=conspicuous.
III=strong.
d=(terræ motus domesticus)=local earthquake (sensible or felt).
v=(terræ motus vicinus)=near-by earthquake (within 1,000 km.).
r=(terræ motus remotus)=distant earthquake (1,000 to 5,000 km. distant).
u=(terræ motus ultimus)=very distant earthquake (beyond 5,000 km.).

Examples.—I_d indicates a local earthquake of small intensity but sensible to individuals.
III_r=indicates a distant earthquake whose record shows motions of considerable amplitude.

PHASES.

P=(undæ primæ)=first preliminary tremors.
PR*n*=P waves reflected *n* times at the earth's surface.
S=(undæ secundæ)=second preliminary tremors.
SR*n*=S waves reflected *n* times at the earth's surface.
PS=transformed waves; longitudinal (P) to transversal (S) or vice versa.
L=(undæ longæ)=long waves in the principal portion.
M=(undæ maximæ)=greatest motion in the principal portion.
C=(coda)=trailers.
F=(finis)=end of sensible disturbance.

NATURE OF THE MOTION.

i=(impetus)=abrupt beginning.
e=(emersio)=gradual appearance.
T=period=twice the time of oscillation.
A=amplitude of the earth's movement, reckoned from the zero line.
E, N, or Z attached to a symbol signifies the E-W, the N-S, or the vertical component, respectively, thus:

A_E is the E-W component of A
A_N is the N-S component of A
A_Z is the vertical component of A
} measured in microns (μ), $\frac{1}{1,000}$ mm.

INSTRUMENTAL CONSTANTS.

T_0=period of the instrument.
V =magnification of the instrument.
ϵ =damping ratio.

SEISMOLOGICAL REPORTS FOR JANUARY, 1916.

By W. J. HUMPHREYS, Professor in charge of Seismological Investigations.

[Dated: Weather Bureau, Washington, D. C., March 1, 1916.]

TABLE 1.—*Noninstrumental earthquake reports, January, 1916.*

Day.	Approximate time, Greenwich Civil.	Station.	Approximate latitude.	Approximate longitude.	Intensity Rossi-Forel.	Number of shocks.	Duration.	Sounds.	Remarks.	Observer.
		CALIFORNIA.								
	H. m.		° ′	° ′			*Secs.*			
1	23 55	Claremont	34 07	117 44						F. P. Brackett.
	23 55	Corona	33 52	117 35	3	1	½	Rumbling		J. W. Garthwaite.
	23 55	Rialto	34 12	117 27	3	2	1		Rattled windows and doors	South California Edison Co.
11	5 15	Cahuilla	33 32	116 43	4	1	10	Rumbling	Windows rattled	Dr. W. L. Shawk.
16	0 41	Peachland	38 24	122 50	2	1	4			E. H. Parnell.
		INDIANA.								
7	19 45	Worthington	39 08	86 58	3	1	5			D. W. Solliday.
		NEVADA.								
18	9 00	Rebel Creek	41 39	117 45		1	2			F. Whitaker.
		NEW YORK.								
5	13 56	Caldwell	43 24	73 43	5	2				Chas. Forsell.
	13 56	Gloversville	43 05	74 21		1				(Press report.)
		OREGON.								
4	18 40	Newport	44 38	124 08	3-4	2			Dishes rattled	Wm. Matthews.
		WASHINGTON.								
2	0 52	Olympia	47 02	122 55	4	3	3		Windows rattled	S. R. Holcomb.
	0 52	Seattle	47 38	122 20	4	1	2		Doors moved	U. S. Weather Bureau.
	0 52	Silverton	48 00	121 32		1	5	Rumbling		C. M. Mackintosh.
	0 52	Sumner	47 12	122 13	4	2	3		Shook buildings	H. E. Thompson.
		PORTO RICO.								
7	15 05	Vieques	18 09	65 27	2	1	1	Faint		H. M. Pease.

TABLE 2.—*Instrumental seismological reports, January, 1916.*

Time used: Mean Greenwich, midnight to midnight. Nomenclature: International.

Alaska. *Sitka.* *Magnetic Observatory.* U. S. Coast and Geodetic Survey. J. W. Green.

Lat., 57° 03′ 00″ N.; long., 135° 30′ 06″ W. Elevation, 15.2 meters.

Instruments: Two Bosch-Omori, 10 and 12 kg.

Instrumental constants: E: V 10, T_0 16.7; N: V 10, T_0 15.6

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Jan. 1		P	13 33 25	6				
		S	13 43 38	7				
		eL_N	13 52 38	26				
		M_N	14 01 30	21		30		
		M_E	14 05 28	16	185			
		C_N	14 06 00	21				
		C_E	14 09 30	17				
		F_E	14 50 00					
		F_N	15 35 00					
13		P	8 44 57	7				
		S_N	8 51 11	15				
		L_N	8 58 14	26				
		eL_E	9 06 18	26				
		M_E	9 07 28	24	12			
		M_N	9 16 10	20		4		
		C_E	9 20 00	19				
		C_N	9 34 00	18				
		F	11 06 00					

Arizona. *Tucson.* *Magnetic Observatory.* U. S. Coast and Geodetic Survey. F. P. Ulrich.

Lat., 32° 14′ 48″ N.; long., 110° 50′ 06″ W. Elevation, 769.6 meters.

Instruments: Two Bosch-Omori, 10 and 12 kg.

Instrumental constants: E: V 10, T_0 16; N: V 10, T_0 19.6

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Jan. 1		L_E	14 05 35	26				No motion on N-S.
		M	14 13 50	18	50			
		C	14 25 00	17				
		F	15 57 00					
13		eL_E	7 13 48	22				
		M_E	7 24 00	17	1			
		F_E	7 34 53					
13		eL	8 55 50	4				
		M_E	9 15 35	22	6			
		M_N	9 28 39	18		1		
		F_N	10 20 49					
		F_E	10 37 23					
15		P	10 00 27	3				
		L	10 01 17					
		M_E	10 01 26	3	3			
		M_N	10 01 53	5		1		
		F	10 08 26					
24		eL_E	7 46 00	21				
		eL_N	7 48 25	28				
		M_E	7 56 55	21	1			
		M_N	7 17 15	21		2		
		F_N	8 11 47					
		F_E	8 14 41					

California. *Berkeley.* *University of California.*

Lat., 37° 52′ 16″ N.; long., 122° 15′ 37″ W. Elevation, 85.4 meters.

(See Bulletin of the Seismographic Stations, University of California.)

California. *Mount Hamilton.* *Lick Observatory.*

Lat., 37° 20′ 24″ N.; long., 121° 38′ 34″ W. Elevation, 1,281.7 meters.

(See Bulletin of the Seismographic Stations, University of California.)

California. *Point Loma.* *Raja Yoga Academy.* F. J. Dick.

Lat., 32° 43′ 03″ N.; long., 117° 15′ 10″ W. Elevation, 91.4 meters.
Instrument: Two-component, C. D. West seismoscope.

(Report for January, 1916, not received.)

California. *Santa Clara.* *University of Santa Clara.* J. S. Ricard, S. J.

Lat., 37° 26′ 36″ N.; long., 121° 57′ 03″ W. Elevation, 27.43 meters.

(See record of the Seismographic Station, University of Santa Clara.)

Colorado. *Denver.* *Sacred Heart College.* Earthquake Station.

A. W. Forstall, S. J.

Lat., 39° 40′ 36″ N.; long., 104° 56′ 54″ W. Elevation, 1,655 meters.
Instrument: Wiechert 80 kg., astatic, horizontal pendulum.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Jan. 1		M	13 — —					Doubtful indications of quake.
		F	14 — —					
13								Doubtful activity here.
15								No sure record here.
16		M_N	15 — —					Visible activity but no record.
		F_N	18 — —					
22		M_E	15 20 00					Activity at hours marked and also during day.
		F_E	17 40 00					
24–27								Activity at intervals on both components.
29		M_E	10 30 —					Activity on E-W.
		F_E	15 -- --					

District of Columbia. *Washington.* *U. S. Weather Bureau.*

Lat., 38° 54′ 12″ N.; long., 77° 03′ 03″ W. Elevation, 21 meters.

Instrument: Marvin (vertical pendulum, undamped. Mechanical registration).

Instrumental constants: V 110, T_0 6.4

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Jan. 1	II_u	P	13 39 45				5,250	
		S	13 46 41					
		L	13 53 30					
		L	13 58 23					
		L	14 12 30	60				
		L	14 16 30	32				
		L	14 23 00	24				
		F	16 35 00					
13		S	6 40 12					P indeterminable.
		L?	6 58 00					
		L	7 19 30	24				
		L	7 30 10	20				
		F	8 15 00					
13	II_u	P?	8 29 52				12,875?	
		S	8 42 44					
		L	9 01 00	48				
		L	9 14 30	60				
		L	9 20 30	30				
		L	9 29 40	30				
		L	9 36 30	20				
		F	11 15 00					
19		L	20 04 40					
		F	20 40 00					

TABLE 2.—*Instrumental seismological reports, January, 1916*—Continued.

District of Columbia. *Washington. U. S. Weather Bureau*—Contd.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Jan. 24	I_u	P?	7 06 58				8,520?	
		S	7 16 44					
		L	7 30 00	42				
		L	7 37 00	28				
		F	8 30 00					
26	I_u	P	7 49 17				7,275?	
		S?	7 58 00					
		L	8 12 30					
		F	8 30 00					
26	I_u	P	12 40 05				11,500?	
		S?	12 52 06					
		L	13 12 30	40				
		L	13 20 30	20				
		F	14 15 00					
30		L	21 24 30					
		L	21 32 30					
		F	21 50 00					
31	I_u	P	18 07 35				8,950	
		S	18 17 43					
		L	18 28 45					
		L	18 31 29	24				
		L	18 37 00	20				
		F	19 15 00					

District of Columbia. *Washington. Georgetown University.* F. L. Tondorf, S. J.

Lat., 38° 54′ 25″ N.; long., 77° 04′ 24″ W. Elevation, 42.4 meters. Subsoil; decayed diorite.

Instruments: Wiechert 200 kg. astatic horizontal pendulums, 80 kg. vertical.

Instrumental constants:

	V	T_0	ε
E	165	5.4	2.6
N	143	5.2	3.4
Z	*80*	*3.0*	*0*

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Jan. 1	III_r	eP_E	13 41 07					Microseisms present; record very doubtful. Mainka shows P later. No distinct M. Recorded on vertical.
		eP_N	13 41 13					
		S_N?	13 50 00					
		L_E	13 58 44					
		L_N	13 58 49					
		F	15 46 00					
13	III_r	e_N	7 25 16					
		e_E	7 26 03					
		L_N	7 27 18					
		L_E	7 28 20					
		F	7 56 00					
13	III_r	eP_E	8 40 18					Microseisms present. Recorded on vertical.
		eP_N	8 40 22					
		S_E	8 43 49					
		S_N	8 43 52					
		L_E	9 00 21					
		L_N	9 00 24					
		M_E	9 22 32	30	3			
		M_N?	9 22 36	30				
		M_E	9 29 04	30	6			
		M_N	9 29 52	30		5		
		M_N	9 38 02	20		5		
		M_E	9 38 47	20	5			
		F_E	10 35 00					
		F_N	10 42 00					
24	II_r	e_N	6 19 07					
		e_E	6 19 12					
		S_E?	6 24 15					
		S_N?	6 24 18					
		F	6 42 00					
24	II_r	eP_N	7 07 00					Series of long waves from 7h 32m to 7h 55m. No distinct M.
		eP_E	7 07 01					
		eL	7 31 06	30				
		F	8 27 00					
31	III_r	eP_N	18 09 33					
		eP_E	18 09 39					
		S	18 20 03					
		R	18 28 20					
		L_E	18 30 25	20				No distinct maximum.
		L_N	18 33 17	20				
		F	19 39 00					

Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Wm. W. Merrymon.

Lat., 21° 19′ 12″ N.; long., 158° 03′ 48″ W. Elevation, 15.2 meters.

Instrument: Milne seismograph of the Seismological Committee of the British Association.

Instrumental constant.. T_0 18.8

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Jan. 1		P	13 30 12					
		S	13 38 12					
		L	13 44 12	22				
		M	13 50 36		*17,200			
		C	15 01 24					
		F	18 37 48					
1		P	23 55 24					
2		L	0 00 48					
		M	0 02 06		*200			
		C	0 07 24					
		F	0 25 00					
2		e	2 04 00					
		M	2 06 00		*100			
		F	2 19 48					
3		e	23 22 12					
		M	23 29 00		*200			
		F	23 34 00					
11		e	11 38 30					
		L	11 43 48					
		M	11 48 00		*200			
		C	12 02 00					
		F	12 22 00					
11		e	17 02 48					
		M	17 08 48		*200			
		F	17 22 12					
13		P	6 30 00					
		S	6 39 18					
		L	6 51 18	22				
		M	7 00 00		*8,600			
		C	7 05 48					
13		P	8 32 30					
		S	8 42 00					
		L	8 52 30	23				
		M	8 58 00		*17,200			
		C	9 10 00					
		F	12 55 00					
13		L	22 20 06	22				
		M	22 27 30		*200			
		C	22 32 06					
		F	22 56 54					
18		e	14 22 48	22				
		M	14 27 30		*200			
		F	14 52 00					
19		e	11 32 06					
		M	11 37 12		*100			
		F	12 01 48					
19		P	19 14 48					
		S	19 20 18					
		L	19 25 48	20				
		M	19 28 54		*2,200			
		C	19 43 36					
		F	20 11 48					
24		e	7 23 06					Phases not well defined.
		M	7 39 54		*400			
		L	7 52 48	24				
		M	8 16 18		*600			
		C	8 27 24					
		F	9 39 00					
26		eL	8 34 06					
		M	8 46 12		*100			
		C	8 51 36					
		F	9 23 06					
26		e	12 39 24					M looks something like a local shock.
		L	12 42 42					
		M	12 44 00		*3,200			
		M	12 48 48		*2,300			
		C	12 56 30					
		F	14 04 36					

* Trace amplitude.

TABLE 2.—*Instrumental seismological reports, January, 1916*—Continued.

Hawaii. *Honolulu. Magnetic Observatory*—Continued.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Jan. 30		P	20 29 06					
		L	20 32 42					
		M	20 35 30		*200			
		F	20 44 00					
30		P	20 51 00					
		S	20 53 54					
		L	20 57 06					
		M	20 59 12		*1,200			
		C	21 04 48					
		F	21 52 54					
31		P	18 19 30					End confused by air currents.
		S	18 24 30					
		L	18 30 00	21				
		M	18 36 42		*2,400			
		C	18 43 30					

* Trace amplitude.

Kansas. *Lawrence. University of Kansas.* Department of Physics and Astronomy. F. E. Kester.

Lat., 38° 57′ 30″ N.; long., 95° 14′ 58″ W. Elevation, 301.1 meters.

Instrument: Wiechert.

Instrumental constants.. {E: V 177, T_0 3.4, e 4.0; N: V 205, T_0 3.4, e 3.8}

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Jan. 1		P	13 39 49					E–W record lost.
		P	13 45 53	2–3				
		S	13 49 14					
		S?	13 55 21					
		S or L	13 59 25					
		L	14 07 33	40–45				
		M	14 24 45	15–20		12		
		F	15 48 00					
13		P	6 36 56					
		P_N?	6 38 54					
		P_E?	6 38 59					
		S	6 48 56					
		S_N or L	6 55 20					
		M_N	7 09 26					
		F_N	7 45 00					
13		P_E?	8 40 04					
		P_N?	8 40 55					
		S_E?	8 46 26					
		S_N?	8 46 33					
		L_N?	8 57 46					
		L_E	8 57 56					
		M_E	9 22 56	24–25	9			
		M_N	9 27 41	23–24		4		
		F	10 45 00					

Maryland. *Cheltenham. Magnetic Observatory.* U. S. Coast and Geodetic Survey. George Hartnell.

Lat., 38° 44′ 00″ N.; long., 76° 50′ 30″ W. Elevation, 71.6 meters.

Instruments: Two Bosch-Omori, 10 and 12 kg.

Instrumental constants.. {E: V 10, T_0 31; N: V 10, T_0 29}

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Jan. 1		P_E	13 46 32					
		S_E	13 51 10					
		S_N	13 51 29	12				
		L_N	13 58 16	36				
		L_E	13 58 34	42				
		M_N	14 26 56	20		25		
		M_E	14 35 10	18	15			
		C	14 43 00	17				
		F	16 05 00					
13		eL_E	7 29 00	19				Phases very uncertain.
		eL_N	7 30 16	19				
		M_E	7 35 00	20	2			
		M_N	7 38 00	20		2		
		F_E	7 43 00					
		F_N	7 55 00					
13		P_E	8 44 11					
		P_N	8 44 20					
		L_E	9 00 34	40				
		L_N	9 01 26	44				
		M	9 31 19	25	12	16		
		C	9 42 00	20				
		F	10 35 00					
24		eL_N	7 31 00	40				Phases uncertain.
		M_E	7 43 00	17	3			
		M_N	7 48 00	17		2		
		C	7 57 00	17				
		F	8 14 00					

Massachusetts. *Cambridge. Harvard University* Seismographic Station. J. B. Woodworth.

Lat., 42° 22′ 36″ N.; long., 71° 06′ 59″ W. Elevation, 5.4 meters. Foundation: Glacial sand over clay.

Instrument: Two Bosch-Omori, 100 kg., horizontal pendulums (mechanical registration).

Instrumental constants.. {E: V 80, T_0 23, e 0; N: V 50, T_0 25, e 4:1}

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Jan. 1		*O?*	*13 24 55*				9,800?	Ottawa makes distance 13,000 Km. i may be PR. E–W records were changed between 13h 46m and 13h 50m; N–S between 13h 54m and 14h 06m. Time on E–W interpolated from hour marks after 13h 50m because of failure of minute ticks. E–W stylus left drum at 14h 27m 20s, returning at 14h 45m 40s.
		i	13 41 30					
		S_N	13 48 26	6				
		eL_E?	13 58 30					
		L_E	14 10 10	44				
		L_N	14 10 12					
		M_E	14 27 20	24				
		C_E	14 52 00					
		F	16 10 00					
6		M_N	3 32 50	0.37		90	0	Local frost crack. Freezing after rain on snow.
		F	3 32 53					
6		M_N	11 13 12	0.44		37		Similar to preceding.
13		*O?*	*6 08 00*				12,850?	Distance and *O* from eL–S, but eS may be earlier among microseisms.
		e_N	6 40 30					
		e	6 41 21					
		e_N	6 41 28					
		e_E	6 41 53					
		S_E?	6 47 41	7				
		eL_E	7 13 11	40				
		L	7 16 02	48				
		L	7 26 06	30				
		M_E	7 34 59	20				
		L	7 38 23	18				F merged in following quake.
13		*O?*	*8 33 30*				7,020?	
		eP_E	8 43 59					
		eP_N	8 44 01					
		i_N	8 49 30	6				
		S_N	8 52 29					
		eL_N	9 01 08	48				
		eL_E	9 01 23	46				
		M_E	9 35 06	21				
		M_E	9 39 41	21				
		M_N	9 43 50	20				
		M_E	9 47 28	20				
		F	11 34 00					
19		L_E	20 05 25	20				Emerged from heavy microseisms.
		F	20 50 00					
24		*O*	*6 55 50*				8,250	
		P_E	7 07 05					N–S stylus thrown against rim of drum.
		S_E	7 16 36	14				
		eL_E	7 30 40					
		L	7 34 30	26				
		M_E	7 42 08	17	19			
		F	8 57 00					
26		*O?*	*7 19 23*				6,500?	
		S_N?	7 57 25	6				P lost in microseisms. All amplitudes very small.
		eL_N	8 06 48					
		eL_E	8 08 56	30				
		L	8 16 46	16				
		F	8 47 00					
26		*O?*	*12 26 50*				12,420?	
		eP?	12 45 02	4				P and S doubtful; difficult to read.
		S_E	12 54 37	10				
		i	12 58 10	8				
		eL_E?	13 19 39					
		L	13 23 14	24–20				L well defined.
		L	{14 04 41 / 14 10 39}	15				{Sheets changed at 13h 43m.
		F	14 58 00					
30		*O?*	*20 57 01*				9,380?	
		eP_N	21 09 28					
		S_E	21 19 52	24				
		eL	21 24 37	28				Sinusoidal waves to F.
		L_E	{21 39 08 / 21 55 07}	18–16				No maximum.
		L_E	22 00 05	15				
		F	22 08 00					

TABLE 2.—*Instrumental seismological reports, January, 1916*—Continued.

Massachusetts. *Cambridge. Harvard University* Seismographic Station—Continued.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Jan. 31	.....	*Of*	*18 11 05*	.....	.....	.....	4,930	
		eP_N?	18 19 35	.....	.....	.....	.....	Masked by microseisms.
		eP_E	18 23 10	4	.....	.....	.....	
		S_N	18 26 13	.....	.....	.....	.....	
		S_E?	18 28 43	8	.....	.....	.....	
		eL_N	18 33 55	24	.....	.....	.....	
		eL_E	18 34 59	.....	.....	.....	.....	
		L_N	18 36 05	.....	.....	.....	.....	
		L_E	18 44 30	15	.....	.....	.....	
		M_E	18 45 49	20	.....	.....	.....	3 waves.
		L_E	18 52 44	.....	.....	.....	.....	
		L_E	19 18 20	16–12	.....	.....	.....	
		F	19 50 00	.....	.....	.....	.....	

Missouri. *St. Louis. St. Louis University.* Geophysical Observatory. J. B. Goesse, S. J.

Lat., 38° 38′ 15″ N.; long., 90° 13′ 58″ W. Elevation, 160.4 meters. Foundation, 12 feet of tough clay over limestone of Mississippi System, about 300 feet thick.

Instrument: Wiechert 80 kg. astatic, horizontal pendulum.

Instrumental constants.. V 80, T_0 7, ϵ: 1 5: 1

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Jan. 1	III_r	eP?	13 30 36	.....	.....	.....	.....	Times doubtful owing to microseisms and wind disturbances.
		S?	13 34 36	.....	.....	.....	.....	
		L?	13 35 48	.....	.....	.....	.....	
		F	13 46 00	.....	.....	.....	.....	
12	.....	e_N	15 26 00	.....	.....	.....	.....	
		F	15 38 00	.....	.....	.....	.....	
12	.....	e_N	15 43 30	.....	.....	.....	.....	
		F	15 46 18	.....	.....	.....	.....	
12	.....	e_N	18 17 18	.....	.....	.....	.....	Microseisms strong from $18^h\ 38^m\ 12^s$ to $4^h\ 9^m$ on Jan. 13.
		F	18 24 00	.....	.....	.....	.....	
13	.....	e_N	7 10 36	.....	.....	.....	.....	
		F	7 33 00	.....	.....	.....	.....	
13	.....	e_E	7 28 30	.....	.....	.....	.....	
		F	7 33 00	.....	.....	.....	.....	
13	.....	e_E	8 41 42	.....	.....	.....	.....	
		F	8 50 00	.....	.....	.....	.....	
13	II_u	eP_N	8 54 00	.....	.....	.....	7,000	
		eP_E	9 03 30	.....	.....	.....	.....	
		L_N	9 12 42	.....	.....	.....	.....	
		L_E	9 23 12	.....	.....	.....	.....	
		F	9 48 00	.....	.....	.....	.....	
24	.....	e_N	1 36 00	.....	.....	.....	.....	
		L_N	1 40 00	.....	.....	.....	.....	
		F	1 52 00	.....	.....	.....	.....	

New York. *Buffalo. Canisius College.* John A. Curtin, S. J.

Lat., 42° 53′ 02″ N.; long., 78° 52′ 40″ W. Elevation, 190.5 meters.

Instrument: Wiechert 80 kg. horizontal.

Instrumental constants.. V 80, T_0 7, ϵ: 1 5: 1

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Jan. 1	III_r	iP_N	13 47 15	.....	.....	.....	5,000	
		eP_E	13 47 15	.....	.....	.....	.....	
		iS_N	13 53 15	.....	.....	.....	.....	
		eS_E	13 53 30	.....	.....	.....	.....	
		L_N	14 12 15	40	.....	10	.....	
		L_E	14 15 00	35	8	.....	.....	
		M_N	14 20 00	30	.....	25	.....	
		M_E	14 21 00	25	50	.....	.....	
		M_E	14 29 00	30	14	.....	.....	
		M_N	14 31 00	25	.....	25	.....	
		M_E	14 32 00	24	12	.....	.....	
		M_N	14 37 00	.....	.....	12	.....	Last maximæ followed by afterquakes.
		F_N	15 43 00	.....	.....	.....	.....	
13	III_r	eP	6 56 30	.....	.....	.....	.....	
		L_E	7 26 00	.....	.....	.....	.....	
		L_N	7 30 00	.....	.....	.....	.....	
		M_E	7 33 00	30	6	.....	.....	
		M_N	7 35 00	.....	.....	.....	.....	
		C_E	7 40 00	.....	.....	.....	.....	
		F_E	7 51 00	.....	.....	.....	.....	

New York. *Buffalo. Canisius College*—Continued.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Jan. 13	III_r	eP_E	8 41 50	.....	.....	.....	.....	
		eP_N	8 42 20	.....	.....	.....	.....	
		eP_E	8 43 00	.....	.....	.....	.....	
		eP_N	8 43 10	.....	.....	.....	.....	
		L_E	8 59 00	.....	.....	.....	.....	
		L_N	9 00 00	.....	.....	.....	.....	
		M_E	9 24 10	40	9	.....	.....	
		M_N	9 24 20	30	.....	6	.....	
		M_E	9 33 00	30	11	.....	.....	
		M_E	9 36 00	25	5	.....	.....	
		M_N	9 41 30	35	.....	9	.....	
		C_E	9 42 00	.....	.....	.....	.....	
		F_N	9 52 00	.....	.....	.....	.....	
		F_E	10 42 00	.....	.....	.....	.....	

New York. *Fordham. Fordham University.* W. C. Repetti, S. J.

Lat., 40° 57′ 47″ N.; long., 73° 53′ 08″ W. Elevation, 23.9 meters.

Instrument: Wiechert 80 kg.

Instrumental constants.. V E 72, N 73; T_0 E 7.2, N 7.2; ϵ E 1.5, N 3.75

(Report for January, 1916, not received.)

Panama Canal Zone. *Balboa Heights* Isthmian Canal Commission.

Lat., 8° 57′ 39″ N.; long., 79° 33′ 29″ W. Elevation, 27.6 meters.

Instruments: Two Bosch-Omori, 100 kg.

Instrumental constants.. V 10, T_0 20

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Jan. 1	.....	L	14 20 10	.....	.....	.....	.....	Distance and direction unknown, No record on N–S, at work on instrument.
		M	14 24 30	.....	150	.....	.....	
		F	15 02 40	.....	.....	.....	.....	
13	.....	P_E	8 40 44	.....	.....	.....	7,240	
		P_N	8 40 49	.....	.....	.....	.....	
		L_N	9 02 41	.....	.....	.....	.....	
		M_E	9 34 30	.....	50	.....	.....	
		M_N	9 34 31	.....	.....	70	.....	
		F_N	10 32 00	.....	.....	.....	.....	
17	.....	P_N	12 29 12	.....	.....	.....	480	Direction unknown.
		P_E	12 29 18	.....	.....	.....	.....	
		L_N	12 30 15	.....	.....	.....	.....	
		L_E	12 30 17	.....	.....	.....	.....	
		M_N	12 30 18	.....	.....	250	.....	
		M_E	12 31 26	.....	300	.....	.....	
		F_N	12 35 22	.....	.....	.....	.....	
		F_E	12 35 34	.....	.....	.....	.....	
24	.....	P	19 48 35	.....	.....	.....	350	Direction unknown.
		L	19 49 19	.....	.....	.....	.....	
		M_N	19 49 27	.....	.....	80	.....	
		M_E	19 49 29	.....	50	.....	.....	
		F_N	19 51 50	.....	.....	.....	.....	
		F_E	19 52 00	.....	.....	.....	.....	
31	.....	P_E	18 05 30	.....	.....	.....	4,830	Waves moved in N–S direction.
		P_N	18 05 36	.....	.....	.....	.....	
		S_N	18 13 00	.....	.....	.....	.....	
		S_E	18 13 05	.....	.....	.....	.....	
		L_E	18 19 30	.....	.....	.....	.....	
		L_N	18 20 26	.....	.....	.....	.....	
		M_E	18 21 40	.....	50	.....	.....	
		M_N	18 23 26	.....	.....	150	.....	
		F_E	18 41 00	.....	.....	.....	.....	
		F_N	18 44 00	.....	.....	.....	.....	

Porto Rico. *Vieques. Magnetic Observatory.* U.S. Coast and Geodetic Survey. H. M. Pease.

Lat. 18° 09′ N.; long., 65° 27′ W. Elevation, 19.8 meters.

Instruments: Two Bosch-Omori.

Instrumental constants.. V E 10, N 10; T_0 E 21.4, N 21.1

(Report for January, 1916, not received.)

TABLE 2.—*Instrumental seismological reports, January, 1916*—Continued.

Vermont. *Northfield. U. S. Weather Bureau.* Wm. A. Shaw.

Lat., 44° 10′ N.; long., 72° 41′ W. Elevation, 256 meters.
Instruments: Two Bosch-Omori, mechanical registration.

Instrumental constants: E: V 10, T_0 15; N: V 10, T_0 16

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Jan. 1	I_r	P?	13 40 20				4,640?	
		S?	13 46 43					
		L	13 58 26	45				
		L	14 13 00	40				
		L	14 21 50	26				
		L	14 25 40	20				
		F	16 20 00					
13		S	6 40 35					Phases indeterminable.
		F	6 50 00					
13		S	8 42 40					P indeterminable.
		L	9 00 47	40				
		L	9 29 15	24				
		F	11 00 00					
24	I_u	P?	7 06 56				8,420?	
		S	7 16 37					
		L	7 29 20	40				
		L	7 34 00	28				
		F	8 10 00					
31		S?	18 19 09					
		L	18 40 00	24				
		F	19 00 00					

Canada. *Ottawa. Dominion Astronomical Observatory.* Earthquake Station. Otto Klotz.

Lat., 45° 23′ 38″ N.; long., 75° 42′ 57″ W. Elevation, 83 meters.

Instruments: Two Bosch photographic horizontal pendulums, one Spindler & Hoyer 80 kg. vertical seismograph.

Instrumental constants.. V 120, T_0 26

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Jan. 1		PR1	13 40 39				13,000	Time at origin=20h 40m.
		i	13 46 34					
		i	13 48 06					
		iS?	13 48 34					
		i	13 51 00					
		eL?	13 58 00	44				
		L	14 10 00	24				
		eL?	14 12 00	44				
		L	14 22 00	22				
		L	14 30 00 / 15 41 00	22-16				
		F	16 35 00					
13		i	6 40 48					Very distant.
		i	6 49 10					
		i	6 50 00	10				
		eL_E	7 12 00	40				
		L_E	7 14 00	40				
		L	7 16 00	40				
		L	7 27 00 / 7 55 00	22-16				
		F	8 20 00					
13		PR1?	8 42 38				6,600?	
		S_N?	8 48 06					
		S_E?	8 48 18					
		eL	9 00 00	44				
		L	9 08 00	28				
		L	9 18 00	38				
		L	9 30 00	20				
		L	9 40 00	18				
		L	10 03 00	18				
		L	10 30 00	20				
		F	11 05 00					
19		eL_E	20 00 42	18				
		L	20 06 00 / 20 38 00	18-16				
		F	20 50 00					
24		P	7 07 06	2			8,160	
		PR1	7 10 34					
		S	7 16 32					
		SR1	7 21 50					
		eL_E	7 30 18	40				
		eL_N	7 30 54	40				
		L	7 33 00	35-28				
		L	7 38 00	24				
		L	7 43 00	16				
		L	7 46 00	14				
		F	8 30 00					

Canada. *Ottawa. Dominion Astronomical Observatory*—Continued.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Jan. 26		P?	7 50 14				5,600?	
		S	7 57 30					
		eL_E	8 07 30	30				
		L_N	8 12 00	26				
		L_E	8 16 00	17				
		F	8 35 00					
26		iE?	12 54 08					
		eL_N	13 14 06	40				
		L_E	13 20 00	27				
		L	13 25 00	18				
		L	13 30 00 / 13 40 00	16-14				
		F	14 10 00					
30		L_E	21 32 00	24				
		L_E	21 35 00 / 21 55 00	20-15				
		F	22 16 00					
31		P_N	18 09 57				8,710	
		S	18 19 53					
		eL_E	18 33 18	40				
		L_E	18 35 00	30				
		L	18 41 00	22-20				
		L_N	18 46 00	16				
		L_E	18 50 00	15				
		L_E	19 02 00	14				
		F	19 45 00					

Canada. *Toronto. Dominion Meteorological Service.*

Lat., 43° 40′ 01″ N.; long., 79° 23′ 54″ W. Elevation, 113.7 meters. Subsoil: Sand and clay.

Instrument: Milne horizontal pendulum, North. In the meridian.

Instrumental constant.. T_0 18. Pillar deviation, 1 mm. swing of boom=0.59″.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Jan. 1		P?	13 39 54					Very large disturbance.
		eS?	13 48 18					
		i	13 50 12					
		i	13 51 12		*400			
		S?	13 55 42					
		L	13 57 24					
		iL	13 58 00	36-42				
		L	14 09 42					
		L	14 18 36	12-24				
		L	14 22 18					
		L	14 26 00	18-24				
		M	14 32 48		*20,000			
		M	14 38 42		*8,000			
		M	14 41 48	18	*4,150			
		L	15 26 36					
		M	15 28 42		*1,150			Small vibrations going on when paper was changed.
11		eL	12 58 48					P not recorded.
		M	12 30 00		*150			
		F	12 43 36					
12								Marked thickening, 18h 40m 48s to 18h 47m 48s. Possibly air currents.
13		P	6 50 36					
		S	6 57 24					
		L	7 09 18					
		L	7 15 00					
		iL	7 26 06					
		L	7 32 12					
		M	7 39 54	18-30	*3,250			
13		iL	9 00 12					P and S merge with trailers from preceding quake.
		L	9 33 12					
		L	9 39 12	18				
		M	9 44 18	18-24	*4,150			
		L	9 47 24					
13		iL	10 31 00	18				Trailers from preceding quake merge with P and S.
		M	10 36 18		*4,000			
		L	10 46 24					
13		L	12 07 24					
		M	12 12 30		*250			
		F?	13 31 42					
19		P	19 51 00				2,688	
		S?	19 55 18					
		iL	20 03 24					
		M	20 09 06		*800			
		F?	20 50 30					

* Trace amplitude.

TABLE 2.—*Instrumental seismological reports, January, 1916*—Concluded.

Canada. *Toronto. Dominion Meteorological Service*—Continued.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Jan. 24		P?	7 13 42					P not well defined. There may be a minute thickening previous to P but impossible to measure.
		S	7 17 54					
		iL	7 23 30					
		L	7 25 54					
		L	7 43 54					
		M	7 46 42		*900			
		F	9 39 18					
26		L	7 59 54					P and S not recorded. Waves occur from 9h 26m 12s to 9h 39m 18s; may be trailers or another quake.
		iL	8 10 54					
		L	8 16 24					
		M	8 17 42		*100			
		F?	8 45 00					
26		P or S	12 53 06					Phases not well defined.
		L or S	13 00 00					
		iL	13 21 48					
		M	13 26 54		*650			
		F?	14 12 00					
30		L	21 31 48					P and S not recorded.
		L	21 34 06					
		M	21 42 36		*150			
		F	22 12 06					
31		S	18 20 12					P lost during attention to instrument.
		iL	18 31 36					
		L	18 41 36					
		M	18 44 06		*350			
		C	18 44 42					
		C	19 33 48 19 37 48					Gradual thickening.
		F	20 02 54					

* Trace amplitude.

Canada. *Victoria, B. C. Dominion Meteorological Service.*

Lat., 48° 24′ N.; long., 123° 19′ W. Elevation, 67.7 meters. Subsoil: Rock.

Instruments: Wiechert, vertical. Milne horizontal pendulum, North; in the meridian.

Instrumental constant.. T_0 18. Pillar deviation: 1 mm. swing of boom=0.54″.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Jan. 1		P	13 33 24					Very large disturbance.
		P	13 37 24					
		S	13 44 48					
		S	13 45 06					
		L	13 50 30					
		M	14 12 36		*15,000			
		M	14 14 36		*8,500			
		M	14 17 36		*3,650			
		L	15 42 12					
		M	15 53 18		*950			
		F	18 58 00					
11		P	11 58 54				2,440	
		S	12 02 54					
		L	12 05 54					
		M	12 07 24		*150			
		F	12 29 54					
13		P	6 43 24				6,440	
		P	6 45 12					
		S	6 51 24					
		L	7 06 54					
		L	7 08 12					
		M	7 19 06		*2,750			F merges into next quake.
13		P	8 32 54				12,250	
		S	8 45 24					
		L	9 06 24					
		M	9 27 00		*2,750			
13		iS	10 29 30					P confused with trailers from preceding quake.
		L	10 36 42					
		M	10 48 48		*650			

* Trace amplitude.

Canada. *Victoria, B. C. Dominion Meteorological Service*—Continued.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1916.			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Jan. 13		L	11 42 42					P and S lost in trailers from preceding quake.
		M	11 47 54		*150			
		F	12 11 54					
19		P?	19 40 30				1,410?	
		S	19 42 29					
		L	19 45 24					
		M	19 47 54		*750			
		F	20 22 06					
24		S	7 19 00					P uncertain.
		L	7 33 54					
		M	7 49 06		*500			
		F	8 44 48					
24		P	9 25 30					S uncertain.
		L	9 28 54					
		M	9 31 24		*100			
		F	9 40 48					
26		P	8 21 00				1,430	
		S	8 23 30					
		L	8 24 54					
		M	8 25 40		*100			
		F	8 39 48					
26		P?	12 48 54					
		S	12 52 54					
		L	13 10 30					
		M	13 16 30		*250			
		F	13 47 42					No reports received after the 29th.

* Trace amplitude.

SEISMOLOGICAL DISPATCHES.[1]

London, Jan. 6, 1916, 4.46 p. m.

An exchange telegraph dispatch from Rome says that Prof. Maladra, Government observer at Mount Vesuvius, announces the volcano has been in active eruption since January 3. Three new craters have been opened and there are constant explosions, large stones being hurled to a height of half a mile. It is said there is no immediate danger from the eruption. (Assoc. Press.)

Petrograd, Russia, Jan. 24, 1916, 5 p. m. (via London, Jan. 24, 10 p. m.)

The seismograph in the Government observatory located 20 miles southwest of here registered an earth shock at 9 o'clock this morning. The intensity of the oscillations was estimated at double those experienced in the great Messina earthquake. The center of the disturbance was fixed at a point 1,500 miles distant. (Assoc. Press.)

London, Jan. 25, 1916.

A heavy earthquake was recorded by the West Bromwich Observatory. The shock was about 2,000 miles away. From certain indications it is said that it may have occurred in Asia Minor in the vicinity of the Black Sea. (Assoc. Press.)

San Francisco, Cal., Jan. 26, 1916.

Pumice stone, presumably from a submarine disturbance, was mixed with the waves which battered the Oceanic Steamship Co's. liner *Sierra* during a hurricane three days out from Sydney, N. S. W., according to a report made by the captain of the steamer which is in port to-day. Capt. Koughan said that a few hours before leaving Sydney, January 5, it was reported to him that seismographs there registered violent disturbances at sea. The *Sierra*, he said, must have passed over the seat of the volcanic outbreak. For hours the ship was in a sea of pumice, pieces varying in size from a marble to a hat being thrown on deck by the waves. (Assoc. Press.)

[1] Reported by the organization indicated and collected by the seismological station at Georgetown University.