TABLE III.—*Data furnished by the Canadian Meteorological Service, January, 1919.*

Stations.	Altitude above M. S. L.[1] Jan. 1, 1916.	Pressure: Station reduced to mean of 24 hours.	Pressure: Sea level reduced to mean of 24 hours.	Pressure: Departure from normal.	Temperature: Mean max. + mean min ÷ 2.	Temperature: Departure from normal.	Temperature: Mean maximum.	Temperature: Mean minimum.	Temperature: Highest.	Temperature: Lowest.	Precipitation: Total.	Precipitation: Departure from normal.	Precipitation: Total snowfall.
	Feet.	*Inches.*	*Inches.*	*Inches.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	*Inches.*	*Inches.*	*Inches.*
St. Johns, N.F.	125	29.59	29.73	−0.13	25.9	+ 2.1	32.6	19.2	58	0	0.16	+0.25	13.0
Sydney, C. B. I.	48	29.82	29.86	− .07	26.4	+ 5.9	33.4	19.3	50	− 5	4.70	−0.10	13.0
Halifax, N. S.	88	29.78	29.88	− .09	27.3	+ 5.5	34.9	19.7	49	− 6	5.06	−0.71	5.8
Yarmouth, N. S.	65	29.81	29.88	− .12	30.3	+ 4.0	37.0	23.6	50	1	5.03	−0.38	6.1
Charlottetown, P. E. I.	38	29.82	29.86	− .10	22.2	+ 5.2	28.5	15.8	44	−12	2.72	−1.24	11.2
Chatham, N. B.	28	29.87	29.90	− .07	15.7	+ 5.9	21.5	6.9	39	−17	3.27	−0.32	31.5
Father Point, Que.	20	29.91	29.94	− .04	10.8	+ 2.8	19.6	2.1	34	−17	4.74	+1.89	45.4
Quebec, Que.	296	29.61	29.95	− .07	13.8	+ 4.7	20.4	7.1	36	−20	3.44	−0.57	33.4
Montreal, Que.	187	29.75	29.97	− .07	18.3	+ 6.6	26.3	10.4	40	−15	2.69	−1.04	16.8
Stonecliffe, Ont.	489	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ottawa, Ont.	276	29.71	29.99	− .04	18.1	+ 8.5	27.3	8.5	40	−20	2.68	−0.31	19.3
Kingston, Ont.	285	29.68	30.01	− .04	25.0	+ 7.9	33.0	17.0	46	−12	1.92	−1.53	11.7
Toronto, Ont.	379	29.56	30.01	− .04	29.3	+ 7.9	36.6	22.0	47	0	1.03	−1.89	4.3
White River, Ont.	1,244	28.54	29.91	− .10	8.5	+ 8.9	20.0	−3.0	35	−37	1.17	−0.22	14.7
Port Stanley, Ont.	592	29.37	30.03	− .04	29.2	+ 7.0	35.7	22.7	47	5	1.49	−1.50	4.9
Southampton, Ont.	656	29.23	.....	.....	27.1	+ 6.7	33.7	20.5	46	− 1	3.16	−0.89	21.0
Parry Sound, Ont.	688	29.24	29.97	− .04	22.9	+ 9.1	31.5	14.3	39	−20	3.58	−0.50	33.0
Port Arthur, Ont.	644	29.23	29.96	− .11	16.7	+13.6	26.2	7.2	38	−22	0.26	−0.56	2.6
Winnipeg, Man.	760	29.08	29.95	− .16	11.0	+17.8	19.1	2.9	37	−26	0.18	−0.70	1.8
Minnedosa, Man.	1,690	28.05	29.96	− .14	9.5	+16.7	19.6	−0.6	38	−35	0.74	−0.06	7.4
Qu'Appelle, Sask.	2,115	27.57	29.90	− .18	17.7	+21.5	27.8	7.6	43	−33	0.70	+0.20	6.6
Medicine Hat, Alberta.	2,144	27.54	29.86	− .21	32.0	+26.5	42.0	22.0	58	−15	0.02	−0.55	.....
Swift Current, Sask.	2,392	27.24	29.88	− .21	25.5	+22.4	34.7	16.3	51	−25	0.50	−0.14	5.0
Calgary, Alberta.	3,428	26.26	29.86	− .17	31.0	+22.6	42.0	20.0	55	6	0.34	−0.19	3.4
Banff, Alberta.	4,521	25.25	29.97	− .03	23.6	+11.5	31.3	15.8	42	−14	2.07	+0.88	20.7
Edmonton, Alberta.	2,150	27.47	29.81	− .22	21.8	+20.0	31.9	11.7	47	−15	1.08	+0.40	10.6
Prince Albert, Sask.	1,450	28.27	29.90	− .19	12.7	+21.1	22.1	3.2	45	−35	0.93	−0.01	9.3
Battleford, Sask.	1,592	28.07	29.87	− .21	15.6	+21.5	27.0	4.2	45	−27	0.74	+0.34	7.4
Kamloops, B. C.	1,292	28.78	30.11	+ .15	30.5	+ 7.5	35.6	25.3	47	5	0.32	−0.50	0.7
Victoria, B. C.	230	29.76	30.02	+ .05	41.3	+ 2.8	45.0	37.6	52	33	5.81	+0.42	.....
Barkerville, B. C.	4,180	25.52	29.89	.00	23.8	+ 6.0	30.1	17.5	38	0	2.30	−0.30	23.0
Hamilton, Bermuda.	151	29.95	30.12	− .01	63.7	+ 1.7	68.7	58.8	71	51	6.56	+1.62	.....

SEISMOLOGICAL TABLES.

SEISMOLOGICAL REPORTS FOR JANUARY, 1919.

W. J. HUMPHREYS, Professor in Charge

[Dated: Seismological Investigations, Weather Bureau, March 3, 1919]

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.).
Δ=distance to epicenter.

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.
O=time at epicenter.
L_{rep_1}=long waves reaching the station from the antiepicenter (40,000 km. $-\Delta$).
L_{rep_2}=long waves again reaching the station from the antiepicenter (40,000 km. $+\Delta$).
F=(finis)=end of perceptible trace.

NATURE OF THE MOTION.

i=(impetus)=abrupt beginning.
e=(emersio)=gradual appearance.
T=period=twice time of oscillation.
A=amplitude of 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:
P_E is the E–W component of P.
P_N is the N–S component of P.
P_Z is the vertical component of P.
μ=micron, $\frac{1}{1,000}$ mm.

INSTRUMENTAL CONSTANTS.

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

TABLE I.—*Noninstrumental earthquake reports, January, 1919.*

Day.	Approximate time, Greenwich civil.	Station.	Approximate latitude.	Approximate longitude.	Intensity, Rossi-Forel.	Number of shocks.	Duration.	Sounds.	Remarks.	Observer.
		CALIFORNIA.								
	m. m.		° ′	° ′			*Sec.*			
Jan. 8	4 07	Hemet	33 45	116 45	2	1	2	Rumbling		C. E. McManigal.
20	9 30	Napa	38 18	122 20	5	1	5	Faint	Awakened people	Geo. A. Lewis.
		St. Helena	38 41	122 30	4	1	.....	None		F. B. Mackinder.
		Vallejo	38 07	122 18	4	1	.....	None	Shock distinct	Press report.
25	22 29	Bakersfield	35 32	119 00	3-4	3	.....		Like heavy trucks passing	F. W. Warthorst.
		Maricopa	35 05	119 23	3	1	.....	None		E. F. Foulke.
		Ojai	34 25	119 12	5	1	1	None		Wm. H. Duncan

TABLE 2.—*Instrumental seismological reports, January, 1919.*

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

[For significance of symbols see this REVIEW, p. 59.]

Alabama. *Mobile. Spring Hill College.* Earthquake Station. Cyril Ruhlmann, S. J.

Lat., 30° 41′ 44″ N.; long., 88° 08′ 46″ W. Elevation, 60 meters.

Instrument: Wiechert 80 kg.; astatic, horizontal pendulum.

(Report for January, 1919, not received.)

Alaska. *Sitka. Magnetic Observatory.* U. S. Coast and Geodetic Survey. F. P. Ulrich.

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

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

Instrumental constants: V, E 10, N 10; T_0, 17.7, 16.6

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919. Jan. 1	.....	P_N	*H. m. s.* 3 12 01	*Sec.* 3	μ	μ	*km.*	Phases marked doubtful are in each case single large irregular waves of 0.5 to 1.0 mm. amplitude.
		P_E	3 12 12	4	.....	.....	.....	
		S_N?.	3 22 34	.....	.....	.....	.....	
		S_E?.	3 22 37	.....	.....	.....	.....	
		M_E.	3 22 48	.....	100	.....	.....	
		e_N?.	3 28 14	.....	.....	.....	.....	
		e_E?.	3 28 18	.....	.....	.....	.....	
		M_N.	3 28 24	.....	.....	90	.....	
		o_E?.	3 34 52	.....	.....	.....	.....	
		e_N?.	3 34 54	.....	.....	.....	.....	
		F_E.	3 44 ..	.....	.....	.....	.....	
		F_N.	3 47 ..	.....	.....	.....	.....	

Arizona. *Tucson. Magnetic Observatory.* U. S. Coast and Geodetic Survey. William H. Cullum.

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

Instruments: Two Bosch Omori, 10 and 12 kg.

Instrumental constants: V, E 10, N 10; T_0, 13.8, 18.4

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919. Jan. 1	.....	P_N	*H. m. s.* 3 12 26	*Sec.*	μ	μ	*km.*	E-W out of order. No well-defined long waves.
		iS_N.	3 22 20	.....	.....	.....	.....	
		M_N.	3 22 30	.....	.....	1,400	.....	
		F_E.	4 22 ..	.....	.....	.....	.....	
17	.....	ePN.	11 54 17	5	.....	.....	.....	
		ePE.	11 54 28	6	.....	.....	.....	
		eS_N.	11 58 29	6	.....	.....	.....	
		eS_E.	11 58 40	6	.....	.....	.....	
		L_N.	12 00 19	14	.....	.....	.....	
		L_E.	12 00 28	16	.....	.....	.....	
		M_N.	12 01 39	9	.....	180	.....	
		M_E.	12 01 48	10	680	.....	.....	
		C_E.	12 03 ..	9	.....	.....	.....	
		C_N.	12 04 ..	9	.....	.....	.....	
		F_N.	12 08 ..	.....	.....	.....	.....	
		F_E.	12 26 ..	.....	.....	.....	.....	
31	.....	e_E.	23 51 55	12	.....	.....	.....	
		e_N.	23 52 29	12	.....	.....	.....	
		M_N.	23 52 45	.....	.....	10	.....	
		M_E.	23 54 ..	.....	20	.....	.....	
Feb. 1	.....	F_E.	0 01 ..	.....	.....	.....	.....	
		F_N.	0 03 ..	.....	.....	.....	.....	

California. *Berkeley. University of California.*

Lat., 37° 52′ 18″ 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.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919. Jan. 6	.....	.....	*H. m. s.*	*Sec.*	μ *30	μ *100	*km.*	Tremors during 24 hours preceding 16h 00m on date given.

* Amplitude on instrument.

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.

(No earthquake recorded during January, 1919.)

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

Lat., 38° 54′ 12″ N.; long., 77° 03′ 02″ W. Elevation, 21 meters.

Instrumental constants: V, 110; T_0, 6.4

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919 Jan. 1	.....	eP.	*H. m. s.* 1 52 55?	*Sec.*	μ	μ	*km* 1,860?	
		eS.	1 56 06	.....	.....	.....	.....	
		eL?	2 07 00	.....	.....	.....	.....	
		L.	2 40 30	28	.....	.....	.....	
		L.	2 55 00	20	.....	.....	.....	F lost in next quake.
1	.....	P.	3 17 44	.....	.....	.....	5,300?	
		S.	3 24 42	.....	.....	.....	.....	
		L.	3 28 40	.....	.....	.....	.....	
		L.	3 31 60	28	.....	.....	.....	
		L.	3 39 30	18	.....	.....	.....	
		F.	5 40 ..	.....	.....	.....	.....	
6	.....	eL.	23 30 30	18	.....	.....	.....	On E-W only.
		F.	23 40 00	.....	.....	.....	.....	
8	.....	eL.	2 01 00	.....	.....	.....	.....	Not on N-S.
		F.	2 07 00	.....	.....	.....	.....	
17	.....	e.	11 55 45	.....	.....	.....	.....	
		S.	12 01 07	.....	.....	.....	.....	
		eL?	12 13 19	.....	.....	.....	.....	
		F.	12 30 00	.....	.....	.....	.....	
31	.....	e.	24 59 30	.....	.....	.....	.....	
Feb. 1	.....	eL.	0 02 50	.....	.....	.....	.....	
		F.	0 20 00	.....	.....	.....	.....	

TABLE 2.—*Instrumental seismological reports, January, 1919*—Continued.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

District of Columbia. *Washington. Georgetown University.*

F. A. 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	0
	N	143	5.2	0
	Z	80	5.0	0

1919	Character.	Phase.	H. m. s.	Sec.	μ	μ	km	Remarks.
Jan. 1	.....	eP_N	1 56 18	.....	.....	.....	.....	Microseisms. No distinct main.
		eP_E	1 56 19	.....	.....	.....	.....	
		eL?	2 25 06	.....	.....	.....	.....	
		L_N	2 33 00	17	.....	.....	.....	
		L_E	2 33 19	17	.....	.....	.....	F in next quake.
1	.....	eP_E	3 17 57	.....	.....	.....	.....	
		eP_N	3 18 17	.....	.....	.....	.....	
		S_E	3 24 37	.....	.....	.....	.....	
		i_N	3 26 39	.....	.....	.....	.....	
		eL_E	3 28 24	.....	.....	.....	.....	
		eL_N	3 28 42	.....	.....	.....	.....	
		i_E	3 30 20	.....	.....	.....	.....	
		i_N	3 34 20	.....	.....	.....	.....	
		i_N	3 38 30	.....	.....	.....	.....	
		F	5 46 ..	.....	.....	.....	.....	
5	.....	e	20 03 00	.....	.....	.....	.....	Little value can be set on these data because of local disturbances.
		S?	20 10 11	.....	.....	.....	.....	
		F	20 35 ..	.....	.....	.....	.....	
8	.....	e_E	1 58 17	.....	.....	.....	.....	Scarcely visible on N-S.
		eL_E	2 01 ..	.....	.....	.....	.....	
		F	2 09 ..	.....	.....	.....	.....	
17	.....	eP_E	11 53 41	.....	.....	.....	.....	Heavy microseisms F difficult.
		eP_N	11 54 00	.....	.....	.....	.....	
		S_E	12 01 07	.....	.....	.....	.....	
		S_N	12 01 08	.....	.....	.....	.....	
		L_E	12 16 55	11	.....	.....	.....	
		L_N	12 17 55	11	.....	.....	.....	
		F?	12 50 ..	.....	.....	.....	.....	
			VERTICAL.					
		eP_Z	11 53 46	.....	.....	.....	.....	
		L_Z	12 18 12	10	.....	.....	.....	
		F_Z	12 43 ..	.....	.....	.....	.....	
27	.....	e_E	21 59 11	.....	.....	.....	.....	
		i_E	21 59 25	.....	.....	.....	.....	
		eL_E?	22 16 54	.....	.....	.....	.....	F?.
31	.....	e_N	23 58 22	.....	.....	.....	.....	Microseisms.
Feb. 1	.....	eL	0 03 30	.....	.....	.....	.....	
		L_E	0 05 43	11	.....	.....	.....	
		L_N	0 07 25	11	.....	.....	.....	
		F	0 20 ..	.....	.....	.....	.....	

Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Frank Neumann.

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
	18.6

1919	Character.	Phase.	H. m. s.	Sec.	μ	μ	km	Remarks.
Jan. 1	.....	P	1 45 24	19	.....	.....	.....	
		S	1 55 12	17	.....	.....	.....	
		L	2 08 18	22	.....	.....	.....	
		M	2 22 18	18	*6,300	.....	.....	
		C	2 42 ..	19	.....	.....	.....	F in next quake.
1	.....	e	3 07 36	10	.....	.....	.....	Waves of amplitude greater than the width of the record began abruptly at 3h 14m30s.
		L	3 14 30	20	.....	.....	.....	
		M	3 15 00	20	*17,000	.....	.....	
		C	3 28 ..	18	.....	.....	.....	
		F	7 18 ..	.....	.....	.....	.....	
5	.....	eP	20 17 24	18	.....	.....	.....	
		L	20 38 00	23	.....	.....	.....	
		M	20 44 00	19	*400	.....	.....	
		C	20 47 ..	18	.....	.....	.....	
		F	21 12 ..	.....	.....	.....	.....	
6	.....	P	22 32 42	16	.....	.....	.....	
		S	22 40 00	20	.....	.....	.....	
		eL	22 46 54	20	.....	.....	.....	
		M	22 55 00	18	*4,000	.....	.....	
		C	22 58 ..	18	.....	.....	.....	
		F	25 30 ..	.....	.....	.....	.....	

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

Hawaii. *Honolulu*—Continued.

1919	Character.	Phase.	H. m. s.	Sec.	μ	μ	km.	Remarks.
Jan. 7	.....	eL	12 41 06	.....	.....	.....	.....	
		M	12 47 48	18	*100	.....	.....	
		F	12 53 ..	.....	.....	.....	.....	
8	.....	eL	2 37 00	.....	.....	.....	.....	
		M	2 43 12	18	*100	.....	.....	
		F	2 47 ..	.....	.....	.....	.....	
8	.....	eL	6 54 00	.....	.....	.....	.....	
		M	6 58 48	21	*100	.....	.....	
		F	7 06 ..	.....	.....	.....	.....	
8	.....	eL	22 11 06	.....	.....	.....	.....	
		M	22 15 30	18	*100	.....	.....	
		F	22 22 30	.....	.....	.....	.....	
11	.....	eL	10 00 54	20	.....	.....	.....	
		M	10 10 12	18	*200	.....	.....	
		F	10 31 ..	.....	.....	.....	.....	
17	.....	eL	12 17 30	20	.....	.....	.....	
		M	12 21 00	18	*200	.....	.....	
		F	12 25 ..	.....	.....	.....	.....	
27	.....	eL	21 53 00	21	.....	.....	.....	
		M	21 53 24	.....	*200	.....	.....	
		F	22 42 ..	.....	.....	.....	.....	
29	.....	L	3 23 00	.....	.....	.....	.....	Local shock, felt in the islands. Principal portion a *mere* haze (on account of the rapid motion) similar to record of a quake on a magnetograph.
		M	3 23 18	.....	*200	.....	.....	
		C	3 23 48	.....	.....	.....	.....	
		F	3 29 ..	.....	.....	.....	.....	
31	.....	eL	23 55 42	20	.....	.....	.....	
Feb. 1	.....	M	0 02 30	21	*200	.....	.....	
		F	0 14 ..	.....	.....	.....	.....	

* 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..		V	T_0	ε
	E	177	3.4	4:1
	N	205	3.4	4:1

(Report for January, 1919, not received.)

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..		V	T_0
	E	10	15
	N	10	15

1919	Character.	Phase.	H. m. s.	Sec.	μ	μ	km.	Remarks.
Jan. 1	.....	eP_N	1 56 55	.....	.....	.....	.....	
		eP_E	1 56 59	.....	.....	.....	.....	
		eL_E	2 37 40	.....	.....	.....	.....	
		eL_N	2 37 45	.....	.....	.....	.....	
		M_N	2 56 55	20	.....	20	.....	
		M_E	2 57 30	20	10	.....	.....	F in next quake.
1	.....	P_E	3 19 20	3	.....	.....	.....	Record not clear, phases not well defined.
		P_N	3 19 53	3	.....	.....	.....	
		eS_E	3 25 12	.....	.....	.....	.....	
		iS_N	3 26 59	.....	.....	400	.....	
		eL_E	3 29 09	.....	.....	.....	.....	
		M_N	3 34 54	18	.....	460	.....	
		M_E	3 35 19	14	250	.....	.....	
		eL_N	3 39 40	.....	.....	.....	.....	
		C_N	3 58 —	.....	.....	.....	.....	
		C_E	4 17 —	.....	.....	.....	.....	
		F_N	4 48 —	.....	.....	.....	.....	
		F_E	5 10 —	.....	.....	.....	.....	
17	.....	eP_E	12 01 09	10	.....	.....	.....	Phases obscured by microseisms.
		eP_N	12 01 17	9	.....	.....	.....	
		M_N	12 09 30	8	.....	10	.....	
		M_E	12 09 34	10	20	.....	.....	
		F_E	12 31 —	.....	.....	.....	.....	
		F_N	12 33 —	.....	.....	.....	.....	

TABLE 2.—*Instrumental seismological reports, January, 1919*—Continued.

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.

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

Instrumental constants..

	V	T_0	ε
E	80	23	0
N	50	25	4:1

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919. Jan. 1	.....	S_E?....	*H. m. s.* 1 53 51	*Sec.* 10	μ	μ	*km.* 16,000?	
		e_E?....	2 19 42	20	.....	.....	.....	
		eL_E....	2 25 05	35	.....	.....	.....	
		L.....	2 32 23	26	.....	.....	.....	
		M.....	2 36 55	20	.....	.....	.....	
		M.....	2 41 16 ..	24	.....	.....	.....	
		C.....	3 08 ..	15	.....	.....	.....	F in next record.
1	.....	O.....	*8 11 48*	.....	.....	.....	5,200	46° 48′ of arc.
		eP_N....	3 20 24	.....	.....	.....	.....	
		eP_E....	3 20 30	4	.....	.....	.....	
		PR_N....	3 20 56	.....	.....	.....	.....	
		PR_E....	3 20 57	.....	.....	.....	.....	
		e_E.....	3 22 34	8	.....	.....	.....	
		S_E.....	3 27 17	12	.....	.....	.....	
		S_N.....	3 27 41	9	.....	.....	.....	
		SR_N....	3 30 59	.....	.....	.....	.....	Sn, undamped; followed by extraordinary large waves like MM up to 72 mm. Trace undamped.
		eL_E....	3 34 28	20	.....	.....	.....	
		M_N.....	3 36 ..	.....	*66,000	.....	.....	
		M_N.....	3 40 ..	.....	.....	.....	.....	
		M_N.....	3 43 ..	.....	.....	.....	.....	
		M_N.....	3 48 ..	.....	.....	.....	.....	
		M_N.....	3 54 ..	.....	.....	.....	.....	
		C_N.....	3 56 ..	.....	.....	.....	.....	
		L_N.....	4 05 ..	.....	.....	.....	.....	A beautiful lenticular group of sinusoidal waves. Not L_{rep} waves. Must be S waves coming back from anticentrum.
		M_E.....	4 07 ..	.....	.....	.....	.....	
		M_E.....	4 11 ..	.....	.....	.....	.....	
		F_N.....	7 01 44	.....	.....	.....	.....	
4	.....	.....	.....	.....	.....	.....	.....	Several disturbances on N-S between 10^h 44^m and 13h; possibly local temperature effects. Microseisms only on E-W.
6	.....	O?.....	*23 04 16*	.....	.....	.....	4,980?	Time somewhat uncertain.
		S_E?....	23 19 43	8	.....	.....	.....	
		L_E?....	23 26 27	.....	.....	.....	.....	
		L_E.....	23 30 51	20	.....	.....	.....	
7	.....	L_N.....	0 20 49	24	.....	.....	.....	Possibly part of preceding, but shown best on N-S while preceding quake is most legible on E-W.
		L_N.....	0 27 20	24	.....	.....	.....	
		L_N.....	0 45 29	16	.....	.....	.....	
		F.....	0 51 ..	.....	.....	.....	.....	
8	.....	O?.....	*1 43 28*	.....	.....	.....	.....	Powder explosion at Acton, Mass., 26.8 km. away, bearing N. 75° W. Temperature about 0° C. Record superposed on L of preceding. SL probably forced ground wave traveling under sound wave around 333 m. per sec. No check on time at origin obtainable.
		e_N.....	1 59 49	.....	.....	.....	.....	
		SL.....	1 59 54	0.3	.....	.....	.....	
		M_N.....	1 59 57	0.3	5	.....	.....	
		M_N.....	1 59 59	0.3	5	.....	.....	
		M_E.....	1 59 58	0.3	5	.....	.....	
		C_E.....	2 00 03	.....	.....	.....	.....	
		C_N.....	2 00 07	.....	.....	.....	.....	
		F_N.....	2 00 23	.....	.....	.....	.....	
		F_E.....	2 00 24	.....	.....	.....	.....	
9	.....	e.....	11 51 38	.....	.....	.....	.....	
		e_E.....	11 56 48	3	.....	.....	.....	
		e_E.....	11 56 49	10	.....	.....	.....	
		S_E?....	12 02 20	15	.....	.....	.....	
		S_E?....	12 02 33	13	.....	.....	.....	
		L_E.....	12 11 41	12	.....	.....	.....	
		L_E.....	12 17 ..	8	.....	.....	.....	
		C_E.....	13 38 26	.....	.....	.....	.....	
		F.....	12 55 ..	.....	.....	.....	.....	

Massachusetts. *Cambridge*—Continued.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919. Jan. 17	.....	e?.....	*H. m. s.* 11 51 37	*Sec.*	μ	μ	*km.*	Some disturbance also from 8^h onward.
		e_E.....	11 56 55	3	.....	.....	.....	
		e_E.....	11 57 58	10	.....	.....	.....	
		S_E?....	12 02 26	15	.....	.....	.....	
		S_E?....	12 02 42	13	.....	.....	.....	
		L_E?....	12 11 50	12	.....	.....	.....	
		L_N....	12 15 ..	.....	.....	.....	.....	
		L_N....	12 35 ..	.....	.....	.....	.....	
		C_E.....	12 38 ..	.....	.....	.....	.....	
		F_E.....	12 55 31	.....	.....	.....	.....	
18	.....	L_N.....	9 20 52	.....	.....	.....	.....	Earlier phases masked by microseisms. Not recognizable on E-W.
		L_N.....	9 23 41	20	.....	.....	.....	
		L_N.....	9 28 22	15	.....	.....	.....	
		F.....	9 29 35	.....	.....	.....	.....	

Missouri. *Saint 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	T_0	ε
80	7	5:1

(Report for January, 1919, not received.)

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

Lat., 40° 51′ 47″ N.; long., 73° 53′ 08″ W. Elevation, 29.3 meters.

Instrument: Wiechert, 80 kg.

Instrumental constants..

	V	T_0	ε
E	72	5.0	0
N	72	5.0	0

(Report for January, 1919, not received.)

New York. *Ithaca. Cornell University.* Heinrich Ries.

Lat., 42° 26′ 58″ N.; long., 76° 29′ 09″ W. Elevation, 242.6 meters.

Instruments: Two Bosch-Omori, 25 kg., horizontal pendulums (mechanical registration).

Instrumental constants..

	V	T_0	ε
E	13	22	4:1
N	14	25	4:1

1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Jan. 1	.....	e_E?....	1 56 16	5	.....	.....	.....	
		e_E?....	1 56 17	4	.....	.....	.....	
		e_N.....	2 04 45	9	.....	.....	.....	
		e_E.....	2 06 20	10	.....	.....	.....	
		e_E.....	2 11 40	7	.....	.....	.....	
		e_N.....	2 12 05	10	.....	.....	.....	
		e_N.....	2 22 10	14	.....	.....	.....	
		L_E.....	2 30 02	44	.....	.....	.....	
		L_E.....	2 38 30	27	.....	.....	.....	F in next 'quake.
1	.....	eP_N....	3 18 50	3	.....	.....	.....	
		eP_E....	3 19 20	5	.....	.....	.....	
		e_N.....	3 22 05	4	.....	.....	.....	
		e_E.....	3 24 45	8	.....	.....	.....	
		e_E.....	3 27 45	18	.....	.....	.....	
		L_E.....	3 37 ..	24	.....	.....	.....	
		F_E.....	5 51 ..	.....	.....	.....	.....	
17	.....	eP.....	11 56 50	5	.....	.....	.....	
		S_E.....	12 01 36	11	.....	.....	.....	
		S_N.....	12 01 40	13	.....	.....	.....	
		eL.....	12 10 ..	10	.....	.....	.....	
		F.....	12 51 ..	.....	.....	.....	.....	

TABLE 2.—*Instrumental seismological report, January, 1919*—Continued.

Panama Canal. *Balboa Heights.* Governor, Panama Canal.

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

Instruments: Two Bosch-Omori: 100 kg.

Instrumental constants.. V 35, T_0 20

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*km.*	
1919. Jan. 1	.....	P.....	1 53 00	.....	.....	.....	.....	Distance and direction uncertain.
		F.....	1 59 00	.....	.....	.....	.....	
1	.....	P.....	3 16 00	.....	*1,500	*1,600	.....	Distance and direction uncertain.
		F.....	4 20 00	.....	.....	.....	.....	

*Trace amplitude.

Porto Rico. *Vieques. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Wallace M. Hill.

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 17, N 20

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*km.*	
1919. Jan. 1	.....	P_E....	3 19 15	6	.....	.....	.....	Waves of irregular period and amplitude; apparently overlapping waves of different periods, a larger wave showing occasionally when the phases coincide.
		P_N....	3 19 18	3	.....	.....	.....	
		eS_E....	3 29 19	10	.....	.....	.....	
		M_E....	3 30 05	20	200	.....	.....	
		eS_N....	3 30 06	18	.....	.....	.....	
		L_E....	3 35 35	20	.....	.....	.....	
		L_W....	3 35 36	18	.....	.....	.....	
		M_N....	3 35 52	18	.....	190	.....	
		C_W....	3 37 ..	16	.....	.....	.....	
		C_E....	3 40 ..	16	.....	.....	.....	
8	.....	F_N....	4 19 ..	.....	.....	.....	.....	
		F_E....	4 30 ..	.....	.....	.....	.....	

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.. V E 10, N 10; T_0 E 15, N 16

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*km.*	
1919. Jan. 1	.....	eL_E....	2 40 00	24	.....	.....	.....	
		L_E....	2 58 30	20	.....	.....	.....	
		F.....	3 10 00	.....	.....	.....	.....	
1	.....	e.....	3 19 30	.....	.....	.....	.....	
		S_E?....	3 26 54	.....	.....	.....	.....	
		L.....	3 28 50	22	.....	.....	.....	
		L.....	4 05 30	14	.....	.....	.....	
		F.....	5 00 00	.....	.....	.....	.....	

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

Lat., 45° 23′ 33″ N.; long., 75° 42′ 57″ W. Elevation, 83 meters.

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

Instrumental constants.. V 120, T_0 26

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*km.*	
1919. Jan. 1	.....	i_N.....	1 54 27	9	.....	.....	.....	The source lay nearer to Ottowa than Halifax and was probably at least 1,500 km. away from the former. F lost in next 'quake.
		e_N.....	2 03 44	12	.....	.....	.....	
		eL?....	2 26 ..	60	.....	.....	.....	
		L.....	2 36 ..	30	.....	.....	.....	
		L.....	2 40 ..	26	.....	.....	.....	
1	.....	O?....	*3 12 55*	.....	.....	.....	3,200?	Record very confusing, especially due to fact that the i records on N-S were not recorded on E-W and regular phases appearing on latter were not visible on former. Same phenomenon present on Halifax record.
		eP_E?..	3 19 10	.....	.....	.....	.....	
		eS_E?...	3 24 08	.....	.....	.....	.....	
		i_E.....	3 26 37	.....	.....	.....	.....	
		eL_E?..	3 28 30	.....	.....	.....	.....	
		i_N.....	3 29 24	.....	.....	.....	.....	
		i_N.....	3 34 38	.....	.....	.....	.....	
		i_N.....	3 38 40	.....	.....	.....	.....	
		L.....	3 40 ..	30	.....	.....	.....	
		L.....	3 50 ..	30	.....	.....	.....	
		L.....	4 05 ..	18	.....	.....	.....	
		L_N.....	4 10 ..	44	.....	.....	.....	
		L.....	4 20 ..	14	.....	.....	.....	
		L.....	4 35 ..	14	.....	.....	.....	
		L_N.....	4 45 ..	40	.....	.....	.....	
		L_N.....	5 15 ..	35	.....	.....	.....	
		F.....	6	.....	.....	.....	.....	
5	.....	i.....	20 13 07	3	.....	.....	.....	
		eL.....	20 35 ..	19	.....	.....	.....	
		F.....	20 50 ..	.....	.....	.....	.....	
6	.....	eL.....	23 26 .. / 23 40 ..	19	.....	.....	.....	Heavy microseisms.
		L.....	23 50 ..	17	.....	.....	.....	
7	.....	L.....	0 05 ..	15	.....	.....	.....	
		F.....	0 20 ..	.....	.....	.....	.....	
8	.....	e.....	1 58 18	.....	.....	.....	.....	Heavy microseisms.
		eL.....	2 01 ..	19	.....	.....	.....	
		F.....	2 20 ..	.....	.....	.....	.....	
17	.....	O?....	*11 49 44*	.....	.....	.....	3,840?	Short, choppy irregular L waves, the beginning of which can not be accurately determined.
		iP?....	11 56 50	.....	.....	.....	.....	
		e_N?....	12 02 05	.....	.....	.....	.....	
		eS?....	12 02 28	.....	.....	.....	.....	
		eL.....	?	10	.....	.....	.....	
		L.....	12 16 ..	8	.....	.....	.....	
		L.....	12 23 ..	7	.....	.....	.....	
		L_N.....	12 34 ..	.....	.....	.....	.....	
		F.....	13	.....	.....	.....	.....	
18	.....	eL.....	7 12 .. / 7 30 ..	.....	.....	.....	.....	*Barely discernible;* heavy microseisms.
27	.....	e.....	22 03 30	.....	.....	.....	.....	Irregular. Heavy microseisms.
		eL.....	22 09 ..	.....	.....	.....	.....	
		L.....	22 11 .. / 22 25 ..	.....	.....	.....	.....	
		F.....	22 40 ..	.....	.....	.....	.....	

TABLE 2.—*Instrumental seismological reports, January, 1919*—Continued.

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..18 T_s. Pillar deviation, 1 mm. swing of boom—0.45″.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	F	F	*km.*	
Jan. 1		e	2 03 42					Early phases masked by microseisms.
		eL	2 10 06					
		L	2 36 48					
		L	2 53 42					
		M	2 56 06		*1,000			F lost in next 'quake.
1		S	3 16 12					First phases intermixed with trailers of previous quake.
		L?	3 25 54					
		i	3 28 48					
		eL	3 29 24					
		M	3 31 54		*4,000			
		iL	3 36 30					
		iL	3 38 48					
		iL	3 44 42					
		M	3 54 48		*3,400			
		iL	3 55 36					
		iL	3 57 18					
		iL	4 01 30					
		iL	4 09 06					
		iL	4 13 12					
		iL	4 21 24					F lost in microseisms.
5								Heavy microseisms at time of 'quake at other stations.
6		L	23 26 36					
		eL	23 30 30					
		M	23 33 12		*700			
		eL	23 38 36					F lost in microseisms.
7		L	0 41 54					
		eL	0 44 00					
		M	0 46 00		*400			F lost in microseisms.
8		L	2 03 06					
		eL	2 05 24					
		M	2 08 00		*300			F in microseisms.
17		L	12 09 42					Microseisms going on.
		M	12 16 48		*200			F in microseisms.
27		L?	21 56 06					Microseisms going on.
		M?	21 58 06		*300			
		eL?	22 19 00					F in microseisms.
31		L	23 48 48					Small microseisms going on.
		L	23 56 54					
		M			*200			
Feb. 1		L	0 01 48					F in microseisms.

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

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

Instrument: Wiechert, vertical; Milne horizontal pendulum, North. In the meridian.

Instrumental constant..18. T_s Pillar deviation, 1 mm., swing of boom—0.54″.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Jan. 1		P	1 47 32				9,220	F lost in next 'quake.
		S	1 57 53					
		L	2 11 50					
		M	2 41 05		*1,400			
1		P	3 11 00				1,310	
		S	3 13 19					
		L	3 17 17					
		M	3 22 44		*6,300			
		F	6 05 23					
			VERTICAL.		A_Z			
		P	*3 11 18*	*2–3*			*1,040*	*L?, F?*
		S	*3 15 04*	*4–6*				
		M	*3 28 00*	*24*	*143*			
6		L	20 39 59					
		M	20 43 25		*200			
		F	20 51 17					
6		P	22 47 55				4,120	
		S	22 53 49					
		L	23 03 40					
		M	23 16 27		*2,000			
7		F	0 17 28					
			VERTICAL.		A_Z			
		L	*23 06 00*	*24*				
		M	*23 11 00*	*20*	*3*			
7		P	0 44 28				1,710	
		S	0 47 25					
		L	0 51 21					
		M	0 59 13		*300			
		F	1 15 57					
8		P	2 17 08					
		L	2 21 36					
		M	2 24 34		*400			
		F	2 41 55					
17		P	12 09 07				660	
		L	12 10 35					
		M	12 12 04		*2,400			
		F	12 22 53					
			VERTICAL.		A_Z			
		P	*12 09 00*	*2*				*L?, F?.*
		M	*12 12 30*	*10*	*143*			
27		L	21 50 47					
		M	21 58 14		*200			
		F	22 23 01					
31		P	23 45 26	3			615	
		L	23 46 55					
		M	23 47 35		*1,000			
Feb. 1		F	0 03 47					
			VERTICAL.		A_Z			
		P	*23 45 12*	*3*			*600*	
		L	*23 46 34*	*8*				
		M	*23 47 20*	*20*	*6*			
		F	*0 00 00*					

SEISMOLOGICAL DISPATCHES.[1]

No reports for January, 1919.

[1] Reported by the organization indicated and collected by the seismological department of Georgetown University, Washington, D. C.

SEISMOLOGY.*

SEISMOLOGICAL REPORTS FOR FEBRUARY, 1919.

W. J. HUMPHREYS, Professor in Charge.

[Dated: Weather Bureau, Washington, D. C., Mar. 1, 1919.]

TABLE 1.—*Noninstrumental earthquake reports, February, 1919.*

Day.	Approximate time. Greenwich Civil.	Station.	Approximate latitude.	Approximate longitude.	Intensity Rossi-Forel.	Number of shocks.	Duration.	Sounds.	Remarks.	Observer.
	H. m.	CALIFORNIA.	° ′	° ′			Seconds.			
Feb. 9	15 57	San Pedro	32 45	118 14	2	1		None		Geo. Linder.
10	24 00	Bishop	32 22	118 24	5	1		None		Associated Press.
14	22 47	Calexico	32 41	115 30	2	1	0.1	None		H. M. Rouse.
16	15 58	Bakersfield	35 22	119 00	4–5	3		Rumbling	Awakened people	F. W. Warthorst.
		Fairmont	34 15	118 25	5	1	10	Rumbling	Small bells rung	Wm. F. C. Lowe.
		Glennville	35 45	118 42	4	2	5	Rumbling	Sounds with second shock	C. H. Likely.
		Lindsay	36 13	119 06	3–4	1	5	Rattling		Basil Prior.
		Los Angeles	34 03	118 15	5	1		Rumbling	Some clocks stopped	R. A. Nelson.
		Maricopa	35 05	119 08	5	1	20	Rumbling		E. F. Foulke.
		Ojai	34 25	119 12	5	1	3	Faint		W. H. Duncan.
		San Luis Obispo	35 18	120 39	4	1	30	None		J. E. Hissong.
		San Pedro	33 45	118 14	4	1		None		Geo. Linder.
		Santa Barbara	34 23	119 40	5	1		None		Associated Press.
		Springville	36 07	118 50		1	2	Rumbling		Mary Birkhead.
17	20 00	Maricopa	35 05	119 08	2	1	10	Faint		E. F. Foulke.
19	3 52	Amos	33 05	115 16	2		30	None		A. W. Sullivan.
		Barrett	32 43	116 46	4	1	3	None		L. Watts.
		Calexico	32 41	115 30	3	1	3	None		H. M. Rouse.
19	4 03	Calexico	32 41	115 30	2	1	30	None		H. M. Rouse.
19	4 55	Barrett	32 43	116 46	5	1	3	None		L. Watts.
		Brawley	32 59	115 40	4	3			Mud volcanoes active	M. D. Witter.
		Calexico	32 41	115 30	4	3	17	Rumbling	Sharp lurch, direction noticed	H. M. Rouse.
19	5 30	Amos	33 05	115 16	2		30	None		A. W. Sullivan.
19	13 23	Calexico	32 41	115 30	4	1	30	Rumbling	Several lighter shocks	H. M. Rouse.
20	3 59	Calexico	32 41	115 30	4	1	33	Rumbling		H. M. Rouse.
		Imperial	32 50	115 35	4	1		None		Associated Press.
20	8 50	Lone Pine	36 37	118 01	4	4		Rattling		G. F. Marsh.
25	22 39	Berkeley	37 52	122 16	3	1		None	Felt by persons at rest	Dr. E. F. Davis.
		Napa	38 18	122 20	5–6	3	5	Rumbling	Some bells rung	G. A. Lewis.
		Oakland	37 48	122 15	5	1		None		Emma Smith.
		Peachland	38 23	122 48	4	1	2			E. H. Parnell.
		Petaluma	38 15	122 38	5	1	15	Rumbling	Some alarm	John Landis.
		Point Reyes	38 02	122 59	5	1	10	Rumbling		Mrs. John Kelly.
		San Francisco	37 48	122 26	3	1	4	None	Shook objects in tall buildings	U. S. Weather Bureau.
27	19 18	Calexico	32 41	115 30	2	1	5	None		H. M. Rouse.
		NEW MEXICO.								
1	4 30	Socorro	34 08	106 48	4–5		20	Rumbling	Followed by 3 shocks	J. J. Leeson.
1	20 30	Socorro	34 08	106 48	5		30	Rumbling	Some alarm	J. J. Leeson.

* For explanation of abbreviations used in the following tables, see this REVIEW, January, 1919, p. 59.

THE NEW SEISMOGRAPHS AT THE UNIVERSITY OF CHICAGO.

Two Milne-Shaw seismographs, one registering the east-west component the other the north-south component, have recently been installed by the Weather Bureau in Rosenwald Hall of the University of Chicago, the records from which for the months of January and February, 1919, together with the constants of the instruments appear in this number of the REVIEW. The horizontal pendulum of each instrument carries a "steady" mass of only 454 grams. The registration is photographic and is obtained by means of a simple but effective optical train that includes a delicately balanced rotating mirror. The concrete pier upon which the instruments are mounted rests upon bed rock 62′ 10″ below the level of the floor of the seismograph room. While some difficulty is experienced on account of the location, both as to tilting and wind disturbances, the records are for the most part excellent. The machines are maintained and operated by the Weather Bureau in cooperation with the University of Chicago.

The Milne-Shaw seismograph is described in detail in a Handbook on the instrument by the maker J. J. Shaw, West Bromwich, England, and, briefly, in the Report of the British Association for the Advancement of Science for 1915, page 57.—R. H. FINCH.

TABLE 2.—*Instrumental seismological reports, February, 1919.*

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

[For significance of symbols see REVIEW for January, 1919, p. 59.]

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

Alabama. *Mobile. Spring Hill College.* Earthquake Station. Cyril Ruhlmann, S. J.

Lat., 30° 41′ 44″ N.; long., 88° 03′ 46″ W. Elevation, 60 meters.

Instrument: Wiechert 80 kg.; astatic, horizontal pendulum.

(Nothing worth recording during January and February, 1919.)

Alaska. *Sitka. Magnetic Observatory.* U. S. Coast and Geodetic Survey. F. P. Ulrich.

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

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

Instrumental constants..		V	T_0
	E	10	17
	N	10	15

(No earthquake recorded during February, 1919.)

Arizona. *Tucson. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Wm. H. Cullum.

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

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

Instrumental constants..		V	T_0
	E	10	14
	N	10	18

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	*μ*	*μ*	*km.*	
Feb. 16	.....	P_N	16 01 39	.....	.....	.....	.....	Poor record.
	.....	P_E	16 01 39	.....	.....	.....	.....	
	.....	M_E	16 02 —	.....	.....	.....	.....	
		F_N	16 02 —	.....	.....	.....	.....	
		F_E	16 04 —	.....	.....	.....	.....	

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.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	*μ*	*μ*	*km.*	
Feb. 4	.....	.....	.....	.....	*100	*200	.....	Tremors during 24 hours preceding 16h 00m on dates given.
7	.....	.....	.....	.....	*50	*100	.....	
15	.....	.....	.....	.....	*200	*150	.....	
17	.....	.....	.....	.....	*200	*200	.....	

*Amplitude on instrument.

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.

Instrumental constants .....

(No earthquake recorded during February, 1919.)

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	T_0
	110	6.4

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	*μ*	*μ*	*km.*	
Feb. 2	.....	e	20 18 33	.....	.....	.....	.....	
		L	20 27 40	.....	.....	.....	.....	
		F	20 40 ..	.....	.....	.....	.....	
16	.....	e	16 14m47	.....	.....	.....	.....	
		F	16 25 ..	.....	.....	.....	.....	

District of Columbia. *Washington. Georgetown University.* F. A. 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	c
	E	165	5.4	0
	N	143	5.2	0
	Z	*80*	*3.0*	*0*

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	*μ*	*μ*	*km.*	
Feb. 2	.....	e_E?	20 17 07	.....	.....	.....	.....	Microseisms.
		e_{LE}	20 25 24	22	.....	.....	.....	
		l_{ZE}	20 29 07	22	.....	.....	.....	
		l_{ZN}	20 29 56	22	.....	.....	.....	
		F	20 50 ..	.....	.....	.....	.....	
16	.....	e	16 15 28	.....	.....	.....	.....	Heavy microseisms.
		eL_E	16 18 30	11	.....	.....	.....	
		F	16 35 ..	.....	.....	.....	.....	

Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Frank Neumann.

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
	18.1.

Sensitiveness 0.40 arc tilt=1 mm.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	*μ*	*μ*	*km.*	
Feb. 5	.....	P	20 22 00	18	.....	.....	.....	
		L	20 29 30	24	.....	.....	.....	
		M	20 38 30	19	*200	.....	.....	
		C	20 43 ..	19	.....	.....	.....	
		F	21 03 ..	.....	.....	.....	.....	
9	.....	P	13 03 24	18	.....	.....	.....	
		eL	13 15 30	.....	.....	.....	.....	
		M	13 20 ..	16	*100	.....	.....	
		F	13 43 ..	19	.....	.....	.....	
9	.....	P	15 43 36	19	.....	.....	.....	
		L	15 56 00	22	.....	.....	.....	
		M	16 00 30	20	*100	.....	.....	
		F	16 09 ..	.....	.....	.....	.....	
12	.....	P	12 57 54	18	.....	.....	.....	The waves beginning at 13h 05m die out before the swell to maximum.
		eL	13 05 ..	.....	.....	.....	.....	
		M	13 11 12	15	*400	.....	.....	
		C	13 35 ..	18	.....	.....	.....	
		F	13 53 ..	18	.....	.....	.....	
12	.....	P	21 03 42	19	.....	.....	.....	
		eL	21 11 ..	25	.....	.....	.....	
		M	21 18 00	15	*300	.....	.....	
		C	21 25 ..	.....	.....	.....	.....	
		F	21 48 ..	19	.....	.....	.....	
22	.....	P	4 32 42	18	.....	.....	.....	
		L	4 39 48	22	.....	.....	.....	
		M	4 47 00	17	*200	.....	.....	
		C	5 01 ..	18	.....	.....	.....	
		F	5 34 ..	18	.....	.....	.....	

*Trace amplitude.

TABLE 2.—*Instrumental seismological reports, February, 1919*—Continued.

Illinois. *Chicago.* University of Chicago. U. S. Weather Bureau.

Lat., 41° 47′ N.; long., 87° 37′ W. Elevation, 180.1 meters.

Instruments: Two Milne-Shaw horizontal pendulums, 0.45 kg.

Instrumental constants		V	T_0	ε	Sensitivity.
	E	156	12	20:1	1″arc tilt=26.6 mm.
	N	150	8	20:1	1″arc tilt=13.2 mm.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Feb. 2	.....	P.....	20 13 30	.....	.....	.....	3,470	
		S.....	20 18 45	.....	.....	.....	.....	
		L.....	20 22 35	16	.....	.....	.....	
		L.....	20 27 00	20	.....	.....	.....	
		L.....	20 29 ..	16	.....	.....	.....	
		F.....	21 20 ..	.....	.....	.....	.....	
15	.....	P.....	2 31 00	.....	.....	.....	3,965	
		S.....	2 36 45	.....	.....	.....	.....	
		L.....	2 40 00	.....	.....	.....	.....	
		L.....	2 43 ..	15	.....	.....	.....	
		F.....	3 30 ..	.....	.....	.....	.....	
16	.....	P?....	16 06 05	.....	.....	.....	3,170	
		S.....	16 11 00	.....	.....	.....	.....	
		L.....	16 18 00	.....	.....	.....	.....	
		F.....	16 35 ..	.....	.....	.....	.....	
22	.....	S?....	4 38 08	.....	.....	.....	.....	
		L?....	4 45 00	.....	.....	.....	.....	
		F.....	5 30 ..	.....	.....	.....	.....	

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		V	T_0	ε
	E	177	3.4	4:1
	N	205	3.4	4:1

(Report for February, 1919, not received.)

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		V	T_0
	E	10	15
	N	10	15

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Feb. 1	.....	e_E.....	0 02 20	7	.....	.....	.....	[Probably part of quake that had its beginning on Jan. 31st.]
		e_N.....	0 02 49	.....	.....	.....	.....	
		M_N.....	0 06 ..	9	.....	20	.....	
		M_E.....	0 07 ..	10	20	.....	.....	
		F_E.....	0 22 ..	7	.....	.....	.....	
		F_N.....	0 28 ..	8	.....	.....	.....	

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

Lat., 42° 22′ 35″ N.; long., 71° 06′ 59″ W. Elevation, 5.4 meters. Foundation: Glacial sand over clay.

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

Instrumental constants		V	T_0	ε
	E	80	23	0
	N	50	25	4:1

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Jan. 31	.....	*O?*....	*23 55 54*	.....	.....	.....	2,357	P masked by microseisms.
Feb. 1	.....	S_N.....	0 02 20	6	.....	.....	.....	E-W damped 1½: 1 by magnet operating automatic alarm during M of heavy earthquakes.
		eL_N.....	0 03 54	20	.....	.....	.....	
		M_N.....	0 06 32	10	.....	.....	.....	
		F_N?...	0 35 44	.....	.....	.....	.....	
2	.....	*O*.....	*19*	.....	.....	.....	.....	Phases before $L2^h25^m41^s$ much distorted by microseisms.
		e_E.....	20 06 23	8	.....	.....	.....	
		l_N.....	20 06 38	.....	.....	.....	.....	
		e_E.....	20 15 21	6	.....	.....	.....	
		e_N.....	20 17 35	12	.....	.....	.....	
		e_N.....	20 17 56	10	.....	.....	.....	
		L_E?....	20 25 06	20	.....	.....	.....	
		L_E.....	20 25 32	28	.....	.....	.....	
		L_E.....	20 26 31	16	.....	.....	.....	
		F_E.....	20 50 ..	.....	.....	.....	.....	
12	.....	L?....	13 25 51	18	.....	.....	.....	e masked by microseisms.
		L_N.....	13 32 20	20	.....	.....	.....	
		L.....	13 27 21	15	.....	.....	.....	
		F?.....	13 55 ..	.....	.....	.....	.....	
15	.....	*O*.....	*2*	.....	.....	.....	.....	
		e_N.....	2 31 22	.....	.....	.....	.....	
		e.....	2 31 29	6	.....	.....	.....	
		e_E.....	2 34 59	5	.....	.....	.....	
		L_E.....	2 37 49	20	.....	.....	.....	
		L_N.....	2 38 03	.....	.....	.....	.....	
		l_E.....	2 40 25	17	.....	.....	.....	
		L_N.....	2 42 45	12	.....	.....	.....	
		F_E.....	2 53 03	.....	.....	.....	.....	
16	.....	l_E.....	16 20 21	.....	.....	.....	.....	Cf. Ottawa e $16^h16^m16^s$.
		L_E.....	16 20 35	8	.....	.....	.....	
		L_E.....	16 20 43	9	.....	.....	.....	N-S time line tangled by heavy cyclonic tilt of pendulum to north for previous 24 hours.
		F?.....	16 20 52	.....	.....	.....	.....	
22	.....	*O*.....	4	.....	.....	.....	.....	Rather weak record on both components.
		e_N?...	5 00 03	6	.....	.....	.....	
		L_E.....	5 04 22	22	.....	.....	.....	
		L_E.....	5 08 13	14	.....	.....	.....	
		M_N?...	5 12 45 / 5 17 09	14–16	.....	.....	.....	
		F_N?...	5 30 ..	.....	.....	.....	.....	

Missouri. *Saint Louis. St. Louis University.* Geophysical Observatory. J. B. Goosse, 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	T_0	ε
	80	7	5:1

(Report for February, 1919, not received.)

New York. *Ithaca. Cornell University.* Heinrich Ries.

Lat., 42° 26′ 53″ N.; long., 76° 29′ 03″ W. Elevation, 242.6 meters.

Instruments: Two Bosch-Omori, 25 kg., horizontal pendulums (mechanical registration).

Instrumental constants		V	T_0	ε
	E	13	22	4:1
	N	14	25	4:1

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. μ	Amplitude. μ	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Feb. 1	.....	eL.....	0 02 48	12	.....	.....	.....	[Probably part of the quake beginning on Jan. 31.] Early phases lost in microseisms.
		F.....	0 16 ..	.....	.....	.....	.....	
2	.....	eL.....	20 25 33	15	.....	.....	.....	
		F.....	20 36 ..	.....	.....	.....	.....	
15	.....	eL.....	2 41 30	16	.....	.....	.....	
		F.....	2 46 ..	.....	.....	.....	.....	

TABLE 2.—*Instrumental seismological reports, February, 1919*—Continued.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
New York. *New York. Fordham University.* W. C. Repetti, S. J.								
Lat., 40° 51′ 47″ N.; long., 73° 53′ 03″ W. Elevation, 23.9 meters.								
Instrument: Wiechert, 80 kg.								
Instrumental constants.. V: E 72, N 72; T_0: 5.0, 5.0; ε: 0, 0								
(Report for February, 1919, not received.)								
Panama Canal. *Balboa Heights.* Governor, Panama Canal.								
Lat., 8° 57′ 39″ N.; long., 79° 33′ 29″ W. Elevation, 27.6 meters.								
Instruments: Two Bosch-Omori, 25 kg.								
Instrumental constants.. V 10; T_0 20								
1919. Feb. 10	.....	P_N	10 45 36	.....	.....	.....	295	Direction uncertain.
		P_E	10 45 42	.....	.....	.....	.....	
		L_N	10 46 06	.....	.....	.....	.....	
		L_E	10 46 20	.....	.....	.....	.....	
		M_E	10 46 52	.....	*4,100	.....	.....	
		M_N	10 46 58	.....	.....	*800	.....	
		F_N	10 53 00	.....	.....	.....	.....	
		F_E	10 54 00	.....	.....	.....	.....	
*Trace amplitude.								
Porto Rico. *Vieques. Magnetic Observatory.* U. S. Coast and Geodetic Survey. W. M. Hill.								
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: 18, 20								
(No earthquake recorded during February, 1919.)								
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.. V: E 10, N 10; T_0: 15, 16								
1919. Feb. 2	.....	eL	20 26 00	.....	.....	.....	.....	
		F	20 35 ..	.....	.....	.....	.....	
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 80k. vertical seismograph.								
Instrumental constants.. V 120; T_0 26								
1919. Feb. 1	.....	e	0 00 40	.....	.....	.....	.....	Heavy microseisms. [Probably part of quake that had its beginning on Jan. 31.]
		L	0 01 30	14	.....	.....	.....	
		L	0 15 ..	8	.....	.....	.....	
		F	0 20 ..	.....	.....	.....	.....	
2	.....	e	20 17 12	.....	.....	.....	.....	
		e	20 20 ..	12	.....	.....	.....	
		eL	20 24 ..	20	.....	.....	.....	
		L	20 36 ..	12	.....	.....	.....	
		F	20 45 ..	.....	.....	.....	.....	
15	.....	e_N?	2 31 ..	.....	.....	.....	.....	
		e	2 34 36	.....	.....	.....	.....	
		eL	2 38 .. / 2 43 ..	20	.....	.....	.....	
		L	2 45 ..	12	.....	.....	.....	
		F	2 55 ..	.....	.....	.....	.....	
16	.....	e_E	16 16 16	.....	.....	.....	.....	
		i	16 16 39	7	.....	.....	.....	
		F	16 21 ..	.....	.....	.....	.....	
22	.....	e	5 00 ..	.....	.....	.....	.....	
		eL?	5 06 ..	20	.....	.....	.....	
		L	5 11 ..	18	.....	.....	.....	

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
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=0.50″.								
1919. Feb. 2	.....	e	20 20 48	.....	.....	.....	.....	Microseisms make early phases doubtful.
		S	20 24 24	.....	.....	.....	.....	
		eL	20 26 48	.....	.....	.....	.....	
		M	20 28 24	.....	*1,400	.....	.....	F lost in microseisms.
12	.....	L?	13 24 54?	.....	.....	.....	.....	Microseisms going on.
		M	13 35 30	.....	*300	.....	.....	F in microseisms.
15	.....	eL	2 39 18	.....	.....	.....	.....	Marked gradual thickening.
		M	2 42 24	.....	*600	.....	.....	
		F	3 00 00?	.....	.....	.....	.....	
16	.....	L?	16 07 00?	.....	*200	.....	.....	Small microseisms going on.
		F	16 12 00?	.....	.....	.....	.....	
22	.....	L	4 58 54?	.....	.....	.....	.....	Small microseisms going on. F in microseisms.
		L	5 10 12	.....	.....	.....	.....	
*Trace amplitude.								
Canada. *Victoria, B. C. Dominion Meteorological Service.*								
Lat., 48° 24′ N.; long., 123° 19′ W. Elevation, 67.7 meters. Subsoil: Rock.								
Instrument: Wiechert, vertical; Milne horizontal pendulum, North. In the meridian.								
Instrumental constant.. T_0 18. Pillar deviation, 1 mm. swing of boom=0.54″.								
1919. Feb. 2	.....	P	20 24 27?	.....	.....	.....	.....	
		L	20 29 22?	.....	.....	.....	.....	
		M	20 31 49	.....	*200	.....	.....	
		F	20 45 35	.....	.....	.....	.....	
12	.....	P	12 59 32?	.....	.....	.....	.....	
		M	13 28 33	.....	*300	.....	.....	
		F	14 06 59	.....	.....	.....	.....	
16	.....	P	16 05 38?	.....	.....	.....	.....	
		L	16 07 07	.....	.....	.....	.....	
		M	16 09 06	.....	*200	.....	.....	
		F	16 14 33	.....	.....	.....	.....	
22	.....	P	4 51 17?	.....	.....	.....	.....	F?
		M	4 56 42	.....	*100	.....	.....	
*Trace amplitude.								

TABLE 2.—*Instrumental seismological reports, February, 1919*—Contd.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*km.*	

TABLE 3.—*Late reports (instrumental).*

Illinois. *Chicago.* University of Chicago. U. S. Weather Bureau.

Lat., 41° 47′ N.; long., 87° 37′ W. Elevation, 180.1 meters.

Instruments: Two Milne-Shaw horizontal pendulums, .45 kg.

Instrumental constants.	V	T_0	ϵ	Sensitivity.
E	150	12	20:1	1″ arc tilt=26.6 mm.
N	150	8	20:1	1″ arc tilt=13.2 mm.

1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Jan. 1	.....	P.....	1 54 13	.....	.....	.....	8,345	Beginning of L not well defined.
		S.....	2 03 50	.....	.....	.....	.....	
		L.....	2 24 00	20	.....	.....	.....	Record merges into next quake.
		L.....	2 47 00	16	.....	.....	.....	
1	.....	P.....	3 10 27	.....	.....	.....	5,390	
		S.....	3 22 30	.....	.....	.....	.....	
		L.....	3 29 00	30	.....	.....	.....	Beginning of L not well defined.
		F.....	6 40 ..	.....	.....	.....	.....	
Jan. 5	.....	P.....	20 12 19	.....	.....	.....	6,550	
		S.....	20 20 25	.....	.....	.....	.....	
		L.....	20 35 30	.....	.....	.....	.....	
		L.....	20 38 20	20	.....	.....	.....	
		F.....	21 10 ..	.....	.....	.....	.....	
6	.....	e.....	23 17 00	.....	.....	.....	.....	P and S doubtful.
		L.....	23 21 00	25	.....	.....	.....	
		L.....	23 25 00	19	.....	.....	.....	
		L.....	23 31 00	16	.....	.....	.....	
7	.....	F.....	1 10 ..	.....	.....	.....	.....	
8	.....	P?.....	1 45 45	.....	.....	.....	8,300?	More pronounced on E-W than on N-S.
		S?.....	1 55 20	.....	.....	.....	.....	
		eL?.....	2 01 00	.....	.....	.....	.....	
		L.....	2 06 ..	24	.....	.....	.....	
		F.....	2 50 ..	.....	.....	.....	.....	
15	.....	eL.....	2 50 00	20	.....	.....	.....	
		F.....	3 10 ..	.....	.....	.....	.....	
17	.....	P.....	11 55 41	.....	.....	.....	3,015	
		S.....	12 00 25	.....	.....	.....	.....	
		eL.....	12 04 40	.....	.....	.....	.....	
		L.....	12 08 00	16	.....	.....	.....	
		F.....	12 13 10	.....	.....	.....	.....	
18	.....	L.....	7 17 ..	.....	.....	.....	.....	
		F.....	7 40 ..	.....	.....	.....	.....	
27	.....	P.....	21 48 28	.....	.....	.....	6,485	
		S.....	21 56 30	.....	.....	.....	.....	
		L.....	22 06 30	.....	.....	.....	.....	
		L.....	22 12 00	16	.....	.....	.....	
		F.....	23 05 00	.....	.....	.....	.....	
31	.....	P.....	23 49 28	.....	.....	.....	2,625	
		S.....	23 53 43	.....	.....	.....	.....	
		L.....	23 58 ..	16	.....	.....	.....	
Feb. 1	.....	F.....	0 40 ..	.....	.....	.....	.....	

CORRIGENDA.

In the REVIEW for October, 1918, page 482, Canada, Toronto, October 19, remarks should be "Possibly Central America."

In the REVIEW for December, 1918, page 586, Table 2, heading "October" should read "December." Page 588, second column should be headed "Hawaii, Honolulu, continued."

SEISMOLOGICAL DISPATCHES.[1]

Havana, Cuba, Feb. 10, 1919.—A slight earthquake shock was felt this morning at Santiago de Cuba, on the southeastern coast of the island. There are no reports of any damage done.—(Assoc. Press.)

Los Angeles, Cal., Feb. 16, 1919.—An earthquake shock, lasting almost a minute, was felt at 8:45 o'clock this morning at virtually every point in Southern California. No damage has been reported from any section.—(Assoc. Press.)

San Francisco, Cal., Feb. 25, 1919.—A slight earthquake was felt here at 2:39 o'clock this afternoon. No damage was reported.—(Assoc. Press.)

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

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SEISMOLOGICAL TABLES.

SEISMOLOGICAL REPORTS FOR MARCH, 1919.

W. J. HUMPHREYS, Professor in Charge.

[Dated: Weather Bureau, Washington, D. C., May 2, 1919.]

TABLE 1.—*Noninstrumental earthquake reports, March, 1919.*

Day.	Approximate time, Greenwich Civil.	Station.	Approximate latitude.	Approximate longitude.	Intensity Rossi-Forel.	Number of shocks.	Duration.	Sounds.	Remarks.	Observer.
	H. m.	CALIFORNIA.	° ′	° ′			*Sec.*			
Mar. 1	4 19	Lonoak	36 20	120 55	4	1				M. L. Griffin.
7		Brawley	32 59	115 40	4	1		None		M. D. Witter.
15	7 53	San Luis Obispo	35 18	120 39	3–4	1		do	Awakened people	U. S. Weather Bureau.
15	10 31	Calexico	32 41	115 30	4	1	8	Rumbling	Preceded by roaring	H. M. Rouse.
15	10 40	Calexico	32 41	115 30	4	1			Buildings creaked	Do.
19	6 06	Calexico	32 41	115 30	3	1	¾	Rumbling	Abrupt lurch to northeast	Do.
21	11 00	Squirrel Inn	34 07	117 19	4	1		None		Mrs. Sarah Frantz.
27	7 50	Hemet	33 45	116 56	5	1	2	Rumbling		C. E. McManigal.

TABLE 2.—*Instrumental reports, March, 1919.*

(Time used: Greenwich, midnight to midnight. Nomenclature: International.)

[For significance of symbols see REVIEW for January, 1919, p. 59.]

Alabama. *Mobile. Spring Hill College.* Earthquake Station. Cyril Ruhlmann, S. J.

Lat., 30° 41′ 44″ N.; long., 88° 08′ 46″ W. Elevation, 60 meters.

Instrument: Wiechert 80 kg.; astatic, horizontal pendulum.

(No earthquake recorded during March, 1919.)

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:	*V*	T_0
E	10	15
N	10	15

(No earthquake recorded during March, 1919.)

Arizona. *Tucson. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Wm. H. Cullum.

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

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

Instrumental constants:	*V*	T_0
E	10	14
N	10	18

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	a	a	*Km.*	
Mar. 9		P	4 42 00	2	10	10		Apparently a slight near-by shock.
		F	4 45 00	4				

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′ 21″ 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.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Mar. 5					*50	*100		Tremors during 24 hours preceding 16h 00m to 28th and 15h 00m to 31st, on dates given.
12					*50	*50		
18					*100	*150		
20					*100	*100		
21					*100	*100		
24					*100	*100		
25					*100	*150		
26					*100	*100		
28					*100	*100		
30					*100	*100		
31					*50	*50		

*Amplitude on instrument.

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.

1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Mar. 14		L_N	18 40 ..					Very strong activity at intervals during day. Stronger on N-S.
		F_N	22 30 ..					
15		L_N	19 42 ..					Distinct but too small to be analyzed.
		F_N	19 51 ..					
23		L_N	2 27 ..					Small and indistinct.
		F_N	2 37 ..					
31		L_N	12 10 ..					Distinct activity, especially at hours marked. Somewhat doubtful as to being seismic.
		F_N	12 40 ..					

TABLE 2.—*Instrumental reports, March, 1919*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

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

1919	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
Mar. 2		P	*H. m. s.* 3 39 00	*Sec.*	μ	μ	*km.* 9,010	
		S	3 49 11					
		eL	4 08 10	24				
		L_E	4 18 00	20				
		F	4 30 00					
2		P	11 57 26				8,840	
		S	12 07 28					
		SR_1	12 13 00					
		L_E	12 20 50	20				
		L_1	12 27 00	20				
		L_2	12 36 00	20				
		F	13 00 ..					
9		P_N	3 23 07				8,790	Scarcely visible on E–W.
		S_N	3 33 07					
		eL	3 50 30					
		F	4 30 ..					
21		eL	17 03 00	28				
		L_1	17 09 00	20				
		F	17 30 ..					

District of Columbia. *Washington. Georgetown University.*

F, A, Tondori. 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: E 105, N 103, Z 80; T_0: 5.4, 5.2, 5.0; ε: 0, 0, 0

1919	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
Mar. 2		eP_N	*H. m. s.* 3 39 05	*Sec.*	μ	μ	*km.*	Heavy microseisms. No distinct main. F doubtful.
		IP_N	3 39 05					
		IS_N	3 49 18					
		eS_N	3 49 18					
		eL_E	4 02 24	22				
		L_E	4 13 09					
		L_N	4 18 09	21				
		F	4 50 ..					
2		eP_N	11 57 26					Heavy microseisms. No distinct main. F?, difficult.
		eP_E	11 57 46					
		S_E	12 07 45					
		eL_E	12 24 12	32				
		L_E	12 28 08	22				
		L_N	12 30 57	16				
9		S	3 39 12					e is so masked in microseisms that interpretation is impossible. F?
		eL_E	3 50 54	22				
21		eL	17 13 12	26				Heavy microseisms.
		L_E	17 15 02	22				
		F	17 27 ..					

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Frank Neumann.

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.

T_0

Instrumental constant..18.4. Sensitivity, 0.40″.

1918.	Character.	Phase.	Time.	Period T.	Amplitude.	Distance.	Remarks.
Mar. 1		L	*H. m. s.* 14 09 00	*Sec.*	μ	*Km.*	
		M	14 13 30		*220		
		F	14 17 ..				
2		eP	3 51 48				Periods uncertain. Paper moving irregularly.
		S	3 59 06				
		L	4 14 30				
		M	4 19 00		*2,600		
		C	4 27 ..				
		F	6 25 ..				
2		P	12 09 06	19			
		S	12 17 06	20			
		L	12 32 00				
		M	12 37 00	16	*3,900		
		C	12 39 ..				
		F	14 41 ..				
4		eL	8 48 00				
		M	8 50 ..		*100		
		F	8 53 ..				
5		eL	20 17 00				
		M	20 21 30		*100		
		F	20 30 ..				
9		P	3 42 36	18			
		S	3 50 48	19			
		eL	4 03 00	24			
		M	4 09 42	21	*900		
		C	4 12 ..	21			
		F	6 10 ..				
10		P	21 38 42	20			
		eL	21 55 ..	19			
		M	22 05 ..		*100		
		F	22 08 ..				
14		eL	15 06 ..				
		M	15 09 42	20	*100		
		F	15 23 ..				
16		P	7 44 00	20			
		S	7 53 54	18			
		eL	8 06 ..				Beginning of L confused.
		M	8 16 48	20	*600		
		C	8 26 ..	19			
		F	8 54 ..				
19		eL	11 30 00				
		M	11 34 30		*100		
		F	11 38 ..				
21		eP	1 39 00				P faint and uncertain.
		L	1 44 00				
		M	1 49 30	21	*300		
		C	1 55 00	20			
		F	2 02 ..				
21		eP	16 27 00				Preceded and followed by tremors extending to the next quake.
		S	16 29 00				
		eL	16 30 12				
		M	16 35 00	17	*1,800		
		C	16 38 ..	16			
21		P	17 55 06				
		eS	17 58 12				
		eL	18 00 00				
		M	18 03 06	17	*800		
		C	18 10 ..	16			
		F	18 49 ..				
22		eL	16 44 00				Followed by tremors.
		M	16 49 12	16	*200		
		C	16 52 ..				
		F	17 02 ..				
30		eL	11 10 00				Two series of long waves.
		M	11 15 30		*300		
		C	11 25 ..				
		F	11 30 ..				

* Trace amplitude.

TABLE 2.—*Instrumental reports, March, 1919*—Continued.

Illinois. *Chicago.* University of Chicago. U. S. Weather Bureau.

Lat., 41° 47′ N.; long., 87° 37′ W. Elevation, 180.1 meters.

Instruments: Two Milne-Shaw horizontal pendulums, 0.45 kg.

Instrumental constants..		V	T_0	ε	Sensitivity.
	E	150	12	20:1	1″arc tilt=26.6 mm.
	N	150	8	20:1	1″arc tilt=13.2 mm.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919. Mar. 2	.....	P.....	*H. m. s.* 3 39 21	*Sec.*	*μ*	*μ*	*Km.* 9,160	Record very well defined.
		S.....	3 49 40	.....	.....	.....	.....	
		L?.....	4 02 12	.....	.....	.....	.....	On March 6th T_0 on both instruments set to 12 sec. Sensitivity, 28 mm.
		L.....	4 11 00	30	.....	.....	.....	
		L.....	4 15 00	25	.....	.....	.....	
		L.....	4 31 00	20	.....	.....	.....	
		F.....	6 30 ..	.....	.....	.....	.....	
2	.....	P.....	11 57 49	.....	.....	.....	9,085	Well defined record.
		S.....	12 08 04	.....	.....	.....	.....	
		L.....	12 20 42	.....	.....	.....	.....	
		L.....	12 30 00	30	.....	.....	.....	
		L.....	12 43 30	20	.....	.....	.....	
		L.....	12 50 ..	15	.....	.....	.....	
		F.....	15 30 ..	.....	.....	.....	.....	
9	.....	P.....	3 29 18	.....	.....	.....	9,395	P not well defined.
		S.....	3 39 48	.....	.....	.....	.....	
		L?.....	3 55 00	24	.....	.....	.....	
		L.....	4 01 00	30	.....	.....	.....	
		L.....	4 19 ..	16	.....	.....	.....	F in microseisms, 5h.
21	.....	eL.....	16 56 ..	30	.....	.....	.....	Other phases not discernible. Very heavy microseisms.
		L.....	17 11 ..	20	.....	.....	.....	
22	.....	S?.....	16 46 30	.....	.....	.....	.....	
		eL.....	17 14 ..	24	.....	.....	.....	
		F.....	17 50 ..	.....	.....	.....	.....	
25	.....	P.....	3 45 57	.....	.....	.....	2,150	
		S.....	3 49 33	.....	.....	.....	.....	
		L.....	3 50 15	.....	.....	.....	.....	
		F.....	4 20 ..	.....	.....	.....	.....	
26	.....	eL.....	10 45 20	24	.....	.....	.....	Not on N–S. Possibly not seismic.
		L.....	10 51 ..	15	.....	.....	.....	
		F.....	11 20 ..	.....	.....	.....	.....	

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..		V	T_0	ε
	E	177	3.4	4:1
	N	205	3.4	4:1

(Report for March, 1919, not received.)

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..		V	T_0
	E	10	14
	N	10	14

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1918. Mar. 2	.....	P_N.....	*H. m. s.* 3 39 21	*Sec.* 3	*μ*	*μ*	*km.*	No long waves on E–W; a few only on N–S.
		eP'_E...	3 40 01	3	.....	.....	.....	
		S.....	3 49 33	8	.....	.....	.....	
		M.....	3 49 45	.....	20	10	.....	
		eL_N...	4 18 30	20	.....	.....	.....	
		F_N.....	4 38 ..	.....	.....	.....	.....	
2	.....	eP'_N...	12 07 45	.....	.....	.....	.....	
		eP'_E...	12 07 47	.....	.....	.....	.....	
		eL_E....	12 28 39	.....	.....	.....	.....	
		eL_N....	12 30 38	.....	.....	.....	.....	
		M_E.....	12 31 54	20	10	.....	.....	
		M_N.....	12 37 00	20	.....	20	.....	
		F.....	12 45 ..	.....	.....	.....	.....	
9	.....	P_E.....	3 38 44	.....	.....	.....	.....	Record very faint with the exception of P.
		P'_N.....	3 38 47	.....	.....	.....	.....	
		eL_E....	4 00 39	.....	.....	.....	.....	
		eL_N....	4 01 43	.....	.....	.....	.....	
		F_E.....	4 27 ..	.....	.....	.....	.....	
		F_N.....	4 32 ..	.....	.....	.....	.....	

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.

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

Instrumental constants..		V	T_0	ε
	E	80	23	0
	N	50	25	4:1

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919. Mar. 2	.....	*O*.....	*H. m. s.* *8 26.59*	*Sec.*	*μ*	*μ*	*km.* 9,150	P_E masked by microseisms. eL faint and difficult to fix. eL?–S gives Δ=9860. E–W damped 1.5:1.
		iP_N....	3 39 19	6	.....	.....	.....	
		S_N.....	3 49 37	6	.....	.....	.....	
		S_E.....	3 49 49	10	.....	.....	.....	
		i_E.....	3 54 39	10	.....	.....	.....	
		eL_E?..	4 08 39	.....	.....	.....	.....	
		eL_E?..	4 09 07	.....	.....	.....	.....	
		L_N.....	4 09 26	40	.....	.....	.....	
		L_E?....	4 10 19	20	.....	.....	.....	
		M_N?....	4 13 55	20	.....	.....	.....	
		L_N.....	4 24 14	16	.....	.....	.....	
		L_E.....	4 26 50	18–20	.....	.....	.....	
		F.....	5 23 11	.....	.....	.....	.....	
2	.....	*O*.....	*11 45 27*	.....	.....	.....	9,230	Probably from same epicenter as preceding "homocentric."
		iP_N....	11 57 51	.....	.....	.....	.....	
		P'_E?....	11 57 ..	.....	.....	.....	.....	
		S.....	12 08 13	.....	.....	.....	.....	
		i_E.....	12 08 23	20	.....	.....	.....	N-shaped wave, i from east.
		i_N.....	12 08 29	16	.....	.....	.....	N-shaped wave, 1 from north.
		e_E.....	12 13 13	20	.....	.....	.....	
		eL_E....	12 27 15	30	.....	.....	.....	
		eL_N....	12 27 51	40	.....	.....	.....	
		M_E.....	12 29 ..	28	.....	.....	.....	Faint maxima.
		M_N.....	12 31 55	25	.....	.....	.....	
		F_N.....	13 29 ..	.....	.....	.....	.....	
		F_E.....	14 24 ..	.....	.....	.....	.....	
9	.....	*O*.....	*5 17 00*	.....	.....	.....	9,230	Probably same epicenter as two preceding.
		iP_N....	3 29 24	.....	.....	.....	.....	
		S_N.....	3 39 46	.....	.....	.....	.....	
		S_E.....	3 39 52	.....	.....	.....	.....	
		eL_E....	3 59 20	30	.....	.....	.....	eL_N not clear.
		L_E.....	4 02 14	20	.....	.....	.....	
		M_E?....	4 11 38	15+	.....	.....	.....	
		F.....	5 06 ..	.....	.....	.....	.....	
14	.....	.....	.....	.....	.....	.....	.....	E–W out of commission, $11^h\ 56^m$–$13^h\ 42.^m$
22	.....	e_E.....	16 57 50	.....	.....	.....	.....	
		L_E.....	17 01 25	30	.....	.....	.....	Sinusoidal.
		L_N?....	17 04 39	25	.....	.....	.....	
		F.....	17 50 ..	.....	.....	.....	.....	

Missouri. *Saint 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	T_0	ε
	80	7	5:1

(Report for March, 1919, not received.)

New York. *Ithaca. Cornell University.* Heinrich Ries.

Lat., 42° 26′ 58″ N.; long., 76° 29′ 09″ W. Elevation, 242.6 meters.

Instruments: Two, Bosch-Omori, 25 kg., horizontal pendelums (mechanical registration).

Instrumental constants..		V	T_0	ε
	E	13	22	4:1
	N	14	25	4:1

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919. Mar. 2	.....	P_N.....	*H. m. s.* 3 39 18	*Sec.* 5	*μ*	*μ*	*km.*	
		S_E.....	3 49 40	8	.....	.....	.....	
		eL_E....	4 01 50	22	.....	.....	.....	
		F_E.....	4 48 ..	.....	.....	.....	.....	
2	.....	e_N.....	12 08 07	4	.....	.....	.....	
		e_E.....	12 08 16	6	.....	.....	.....	
		e_E.....	12 13 45	20	.....	.....	.....	
		eL_E....	12 23 20	22	.....	.....	.....	
		F_E.....	13 47 ..	.....	.....	.....	.....	
9	.....	e_E.....	3 39 31	6	.....	.....	.....	
		e_N.....	3 39 40	6	.....	.....	.....	
		eL_E....	3 55 38	18	.....	.....	.....	
		F_N.....	4 36 ..	.....	.....	.....	.....	
21	.....	L_N.....	17 01 28	30	.....	.....	.....	
		L_E.....	17 02 56	30	.....	.....	.....	
		F_E.....	17 28 ..	.....	.....	.....	.....	

TABLE 2.—*Instrumental reports, March, 1919*—Continued.

Panama Canal. *Balboa Heights.* Governor, Panama Canal.

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

Instruments: Two Bosch-Omori, 100 kg.

Instrumental constants.. V 35, T_0 20

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919. Mar. 4	.....	P_N	*H. m. s.* 3 14 48	*Sec.*	μ	μ	*km.* 370	
		P_E	3 14 50	.....	.....	.....	.....	
		L_N	3 15 34	.....	.....	.....	.....	
		L_E	3 15 41	.....	.....	.....	.....	
		M_N	3 15 42	.....	.....	*1,500	.....	
		M_E	3 15 49	.....	*1,000	.....	.....	
		F	3 23 00	.....	.....	.....	.....	
26	.....	P_E	5 30 36	.....	.....	.....	500	
		P_N	5 30 41	.....	.....	.....	.....	
		S_E	5 31 24	.....	.....	.....	.....	
		S_N	5 31 28	.....	.....	.....	.....	
		L_E	5 31 41	.....	.....	.....	.....	
		L_N	5 31 43	.....	.....	.....	.....	
		M_E	5 31 44	.....	*2,400	.....	.....	
		M_N	5 31 49	.....	.....	*5,000	.....	
		F	5 39 ..	.....	.....	.....	.....	

* Trace amplitude.

Porto Rico. *Vieques. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Wallace M. Hill.

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 17, N 19

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919. Mar. 2	.....	eL_E	*H. m. s.* 3 59 39	*Sec.* 24	μ	μ	*km.*	
		M_E	4 03 30	18	20	.....	.....	
		eL_N	4 05 32	.....	.....	.....	.....	
		M_N	4 08 31	15	.....	20	.....	
		F	4 10 ..	.....	.....	.....	.....	
2	.....	eP_E	11 58 46	.....	.....	.....	.....	
		L_E	12 18 12	22	.....	.....	.....	
		M_E	12 21 56	18	70	.....	.....	
		L_N	12 23 10	.....	.....	.....	.....	
		M_N	12 25 43	18	.....	60	.....	
		C_N	12 27 ..	18	.....	.....	.....	
		C_E	12 30 ..	18	.....	.....	.....	
		F_N	12 30 ..	.....	.....	.....	.....	
		F_E	12 37 ..	.....	.....	.....	.....	
9	.....	L_E	3 49 56	26	.....	.....	.....	
		M_E	3 51 50	22	20	.....	.....	
		L_N	3 56 56	.....	.....	.....	.....	
		M_N	3 57 36	17	.....	10	.....	
		F	4 01 ..	.....	.....	.....	.....	
24	.....	P_N	20 29 33	2	.....	.....	.....	
		P_E	20 29 39	2	.....	.....	.....	
		M_N	20 30 07	.....	.....	25	.....	
		M_E	20 30 16	.....	15	.....	.....	
		F_N	20 33 ..	.....	.....	.....	.....	
		F_E	20 34 ..	.....	.....	.....	.....	

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.. V: E 10, N 10; T_0: E 15, N 18

(No earthquake recorded during March, 1919.)

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 & Hoye 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.
1919. Mar. 2	.....	*O*.....	*H. m. s.* *3 27 11*	*Sec.*	μ	μ	*km.* 9,260	
		iP_N	3 39 36	.....	.....	.....	.....	
		eS_N	3 49 59	.....	.....	.....	.....	
		eS_E	3 50 14	.....	.....	.....	.....	
		eL.....	4 10 ..	40	.....	.....	.....	
		L.....	4 15 ..	25	.....	.....	.....	
		L.....	4 25 ..	17	.....	.....	.....	
		L.....	4 30 ..	19	.....	.....	.....	
		L.....	4 40 ..	17	.....	.....	.....	F in microseisms, 5[h].
2	.....	*O*.....	*11 45 21*	.....	.....	.....	9,520	
		eP_N	11 58 00	.....	.....	.....	.....	
		S.....	12 08 36	.....	.....	.....	.....	
		SR_1..	12 14 42	.....	.....	.....	.....	
		L.....	12 27 ..	.....	.....	.....	.....	
		L.....	12 30 ..	30	.....	.....	.....	
		L.....	12 40 ..	20	.....	.....	.....	
		L.....	12 50 ..	17	.....	.....	.....	
		L.....	13 00 ..	14	.....	.....	.....	
		L.....	13 15 ..	13	.....	.....	.....	
		L_N.....	13 40 ..	16	.....	.....	.....	F in microseisms, 14[h] 00[m].
9	.....	*O*.....	*3 17 10*	.....	.....	.....	9,380	The three quakes bear a remarkable resemblance to one another in general appearance in all phases. The values are as read but the exact second for S is difficult to determine and the difference in △ is probably due to this.
		P_N.....	3 29 42	.....	.....	.....	.....	
		PR_{1N}.	3 33 12	.....	.....	.....	.....	
		S_N.....	3 40 11	.....	.....	.....	.....	
		S_E.....	3 40 25	.....	.....	.....	.....	
		eL_E...	4 00 ..	24	.....	.....	.....	
		L_E.....	4 12 ..	20	.....	.....	.....	
		L.....	4 20 ..	18	.....	.....	.....	
		L.....	4 27 ..	15	.....	.....	.....	
		L.....	4 35 ..	16	.....	.....	.....	
		.....	.....	.....	.....	.....	.....	F in microseisms, 5[h] ..
16	.....	e?.....	8 10 24	.....	.....	.....	.....	Heavy microseisms.
		eL_E...	8 30 ..	30-20	.....	.....	.....	
			8 55 ..					
		F.....	9 00 ..	.....	.....	.....	.....	
17	.....	eL.....	8 30 ..	20	.....	.....	.....	
			8 37 ..					
21	.....	eL.....	17 02 ..	18	.....	.....	.....	Heavy wind tremors and microseisms. L waves of small amplitude.
			17 25 ..					
22	.....	eL.....	17 24 ..	*18*	.....	.....	.....	*Barely discernible.*
			17 30 ..					
25	.....	i.....	3 51 24	.....	.....	.....	.....	May not be seismic.
		e.....	3 52 ..	.....	.....	.....	.....	
			4 00 ..					
26	.....	eL.....	10 48 ..	28	.....	.....	.....	Very small; barely discernible.
			10 59 ..					

TABLE 2.—*Instrumental reports, March, 1919*—Continued.

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.

T_0
Instrumental constant.. 18. Pillar deviation, 1 mm. swing of boom=0.45″.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Mar. 2	.....	PR?	3 46 36	.....	.....	.....	.....	Real P possibly not recorded. Times doubtful.
		eS	3 50 42	.....	.....	.....	.....	
		L	4 07 48	.....	.....	.....	.....	
		eL	4 34 00	.....	.....	.....	.....	
		M	4 40 06	.....	*1,800	.....	.....	
		L	6 06 42?	.....	.....	.....	.....	
		F	6 09 48	.....	.....	.....	.....	
2	.....	P	12 01 06?	.....	.....	.....	.....	S waves fairly large. Times doubtful.
		iS	12 09 18	.....	.....	.....	.....	
		S	12 11 00	.....	.....	.....	.....	
		S	12 15 24	.....	.....	.....	.....	
		eL	12 26 12	.....	.....	.....	.....	
		L	12 37 24	.....	.....	.....	.....	
		L	12 40 42	.....	.....	.....	.....	
		iL	12 43 36	.....	.....	.....	.....	
		M	12 45 36	.....	*1,200	.....	.....	
		eL	12 48 48	.....	.....	.....	.....	
		eL	13 36 12	.....	.....	.....	.....	
		F	14 34 12?	.....	.....	.....	.....	
4	.....	L	9 18 48?	.....	*50	.....	.....	
9	.....	P	3 28 42	.....	.....	.....	11,920	P waves very minute; S fairly large.
		PR	3 35 06	.....	.....	.....	.....	
		iS	3 41 00	.....	.....	.....	.....	
		iS	3 46 48	.....	.....	.....	.....	
		L?	3 59 36	.....	.....	.....	.....	
		eL	4 10 42	.....	.....	.....	.....	
		eL	4 14 36	.....	.....	.....	.....	
		M	4 16 36	.....	*700	.....	.....	
		eL	4 25 30	.....	.....	.....	.....	
		eL	5 26 00	.....	.....	.....	.....	
		F	5 39 00	.....	.....	.....	.....	
16	.....	eL	8 47 36	.....	*100	.....	.....	Gradual thickening.
		F	9 20 48	.....	.....	.....	.....	
17	.....	L	8 31 48	.....	*50	.....	.....	
		F	8 37 06	.....	.....	.....	.....	
19	.....	eL	2 42 54	.....	.....	.....	.....	Gradual thickening. May not be seismic.
		M	2 44 24	.....	*300	.....	.....	
		F	2 55 24	.....	.....	.....	.....	
21	.....	eL	17 00 30	.....	.....	.....	.....	Merged into next quake.
		eL	17 03 00	.....	.....	.....	.....	
		M	17 15 18	.....	*900	.....	.....	
		eL	17 22 06	.....	.....	.....	.....	
21	.....	eL	18 37 48	.....	.....	.....	.....	Dual earthquake.
		M	18 44 06	.....	*200	.....	.....	
		F	19 02 42	.....	.....	.....	.....	
26	.....	L	10 50 24	.....	*100	.....	.....	
		F	10 54 24	.....	.....	.....	.....	

* Trace amplitude.

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

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

Instrument: Wiechert, vertical; Milne horizontal pendulum, North. In the meridian.

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

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Mar. 2	.....	P	3 50 46	.....	.....	.....	6,290	Vertical: M at $4^h\ 17^m\ 20^s$ with $\mu=1$.
		S	3 58 38	.....	.....	.....	.....	
		L	4 10 27	.....	.....	.....	.....	
		eL	4 17 13	.....	.....	.....	.....	
		M	4 21 46	.....	*800	.....	.....	
		F	6 18 19	.....	.....	.....	.....	
2	.....	P	12 09 00	.....	.....	.....	5,730	Vertical: M at $12^h\ 40^m\ 30^s$ with a period of 16^s and $\mu=3$.
		S	12 16 22	.....	.....	.....	.....	
		L	12 26 46	.....	.....	.....	.....	
		M	12 40 28	.....	*200	.....	.....	
		F	14 22 16	.....	.....	.....	.....	
4	.....	P	9 03 45?	.....	.....	.....	.....	
		M	9 12 36	.....	*200	.....	.....	
		F	9 27 41	.....	.....	.....	.....	
9	.....	P	3 50 34	.....	.....	.....	4,720	
		S	3 57 01	.....	.....	.....	.....	
		L	4 04 28	.....	.....	.....	.....	
		M	4 12 53	.....	*500	.....	.....	
		F	5 59 00*	.....	.....	.....	.....	Clock stopped from 17^h of the 15^{th} to early morning of the 17^{th}.
21	.....	P	16 24 39	.....	.....	.....	5,190	
		S	16 31 32	.....	.....	.....	.....	
		L	16 42 50	.....	.....	.....	.....	
		M	16 54 09	.....	*2,500	.....	.....	
		F	17 13 50	.....	.....	.....	.....	
			VERTICAL.		A_Z			
		L	*16 44 00*	*20*	.....	.....	.....	
		M	*16 48 56*	*20*	*4*	.....	.....	
21	.....	P	18 04 59	.....	.....	.....	4,640	
		S	18 11 22	.....	.....	.....	.....	
		L	18 21 12	.....	.....	.....	.....	
		M	18 35 28	.....	*200	.....	.....	
		F	18 47 16	.....	.....	.....	.....	
22	.....	L	17 02 37	.....	.....	.....	.....	
		M	17 08 31	.....	*300	.....	.....	
		F	17 22 47	.....	.....	.....	.....	

*Trace amplitude.

TABLE 3.—*Late reports (Instrumental).*

New York. *Ithaca. Cornell University.* Heinrich Ries.

Lat., 42° 26′ 58″ N.; long., 76° 29′ 09″ W. Elevation, 242.6 meters.

Instruments: Two Bosch-Omori, 25 kg., horizontal pendulums (mechanical registration).

		V	T_0	e
Instrumental constants..	E	13	22	4:1
	N	14	25	4:1

Date.	Character.	Phase.	Time.	Period T.	μ	μ	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*			*km.*	
Feb. 2	.....	eL	20 25 33	15	.....	.....	.....	In addition to the quake of Feb. 1 *given in the* February Review.
		F	20 36 ..	.....	.....	.....	.....	
15	.....	eL	2 41 30	16	.....	.....	.....	
		F	2 46 ..	.....	.....	.....	.....	

SEISMOLOGICAL DISPATCHES.[1]

No dispatches for March, 1919.

[1] Reported by the organization indicated and collected by the seismological department of Georgetown University, Washington, D. C.

SEISMOLOGY.

W. J. HUMPHREYS, Professor in Charge.

[Dated: Weather Bureau, Washington, D C., June 3, 1919.]

TABLE 1.—*Noninstrumental earthquake reports, April, 1919.*

Day.	Approximate time, Greenwich Civil.	Station.	Approximate latitude.	Approximate longitude.	Intensity Rossi-Forel.	Number of shocks.	Duration.	Sounds.	Remarks.	Observer.
	H. m.	ARKANSAS.	° ′	° ′			*Sec.*			
Apr. 8	8 40	Ravenden	36 30	91 11	3–4				May not be a quake	L. H. Walker.
		CALIFORNIA.								
1	5 46	Calexico	32 41	115 30	3	1		Rumbling		H. M. Rouse.
13	14 18	Stanford University	37 26	122 12	2	1	2	None		Dr. S. D. Townley.
19	9 24	Calexico	32 41	115, 30	3	1	3	Rumbling	Preceded by a jar	H. M. Rouse.

NOTE.

The following note by D. L. Hazard, Chief of Division of Terrestrial Magnetism, U. S. Coast and Geodetic Survey, gives some records of the sea waves produced by the earthquake of April 30, 1919:

"The tide gages of the United States Coast and Geodetic Survey at San Diego, and San Francisco, Calif., and Honolulu, Hawaii, recorded a marked tidal disturbance on April 30, 1919.

"At San Francisco, the first effect is shown on the tidal record at $18^h\ 40^m$ Greenwich mean time, at San Diego at $18^h\ 45^m$, and at Honolulu at $13^h\ 45^m$. The principal effect lasted from 12 to 20 hours and there are indications of a disturbance some hours later, although it can not be determined whether the effect was produced by wind or by the earthquake.

"The records of this earthquake from the seismographs at the magnetic observatories of this bureau are somewhat confused, and suggest the possibility that there may have been two earthquakes at nearly the same time, but the indications are that the principal earthquake occurred at about $7^h\ 16^m$ Greenwich mean time, the origin being somewhere in the southern Pacific."

TABLE 2.—*Instrumental seismological reports, April, 1919.*

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

[For significance of symbols see REVIEW for January, 1919, p. 59.]

Alabama. *Mobile. Spring Hill College.* Earthquake Station. Cyril Ruhlmann, S. J.

Lat., 30° 41′ 44″ N.; long., 88° 08′ 46″ W. Elevation, 60 meters.

Instrument: Wiechert 80 kg.; astatic, horizontal pendulum.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Apr. 17	.....	eP	20 57 10	.....	.....	.....	.....	E-W component undamped.
		iS_E	21 00 10	.....	.....	.....	.....	
		iS_N	21 00 25	.....	.....	.....	.....	
		L	21 00 45	5			.....	
		M_E	21 00 50	5	*11,000	.....	.....	
		M_N	21 05 40	5	.....	*5,000	.....	
		F	21 17 ..	.....	.....	.....	.....	
30	.....	e_E	7 35 50	.....	.....	.....	.....	Poor record.
		i	7 41 55	.....	.....	.....	.....	
		e_N	7 43 42	.....	.....	.....	.....	
		i	8 10 00	.....	.....	.....	.....	
		F	8 42 ..	.....	.....	.....	.....	

*Trace amplitude.

Alaska. *Sitka. Magnetic Observatory.* U. S. Coast and Geodetic Survey. F. P. Ulrich.

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

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

Instrumental constants.. $\begin{cases} E & V = 10 & T_0 = 17.7 \\ N & 10 & 16.6 \end{cases}$

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Apr. 17	.....	eP_E	21 10 06	.....	.....	.....	.....	
		eP_N	21 10 12	.....	.....	.....	.....	
		eI_E	21 21 30	.....	.....	.....	.....	
		eL_E	21 26 15	.....	.....	.....	.....	
		M_E	21 27 20	16	20	.....	.....	
		M_N	21 30 30	15	.....	10	.....	
		F_N	21 31 ..	.....	.....	.....	.....	
		F_E	21 36 ..	.....	.....	.....	.....	
18	.....	eL_E	21 26 00	.....	.....	.....	.....	Nothing on N-S.
		M_E	21 28 ..	10	10	.....	.....	
		F	21 36 ..	.....	.....	.....	.....	
30	.....	P_N	7 29 37	4	.....	.....	.....	
		eP_E	7 29 40	.....	.....	.....	.....	
		eS_N	7 40 49	9	.....	.....	.....	
		eS_E	7 41 11	11	.....	.....	.....	
		eL_E	8 04 14	18	.....	.....	.....	
		eL_N	8 04 42	.....	.....	.....	.....	
		M_E	8 19 41	17	40	.....	.....	
		M_N	8 19 48	16	.....	60	.....	
		C_N	8 20 ..	16	.....	.....	.....	
		C_E	8 31 ..	16	.....	.....	.....	
		F_N	9 03 ..	.....	.....	.....	.....	
		F_E	9 57 ..	.....	.....	.....	.....	

TABLE 2.—*Instrumental seismological reports, April, 1919*—Continued.

Arizona. *Tucson. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Wm. H. Cullum.

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

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

Instrumental constants.. V T₀: E 10 15; N 10 18

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	*μ*	*μ*	*km.*	
Apr. 17	.....	P_N	20 58 29	4	.....	.....	.....	
		P_E	20 58 48	2	.....	.....	.....	
		iS_N	21 03 06	.....	.....	.....	.....	
		iS_E	21 03 11	.....	.....	.....	.....	
		L_N	21 06 35	20	.....	.....	.....	
		L_E	21 06 40	.....	.....	.....	.....	
		M_E	21 09 50	.....	*130	.....	.....	
		M_N	21	18	.....	*6,650	.....	Amplitude greater than given. Stylus off from 21h 10m to 21h 13m.
		C.....	21 14 ..	16	.....	.....	.....	
		F.....	21 26 ..	.....	.....	.....	.....	
18	.....	P_N	21 04 37	3	.....	.....	.....	
		eS_E	21 07 23	.....	.....	.....	.....	
		L_E	21 08 30	.....	.....	.....	.....	
		L_N	21 09 00	19	.....	.....	.....	
		M_E	21 10 23	9	*320	.....	.....	
		C_E	21 11 ..	7	.....	.....	.....	
		M_N	21 11 20	9	.....	*300	.....	
		Cn....	21 14 ..	.....	.....	.....	.....	
		Fe....	21 15 ..	.....	.....	.....	.....	
		Fn....	21 31 ..	.....	.....	.....	.....	
19	.....	e_N	3 08 23	.....	.....	*50	.....	No definite phases.
		e_E	3 08 37	.....	*30	.....	.....	
		F.....	3 14 ..	.....	.....	.....	.....	
30	.....	P_N	7 29 22	4	.....	.....	.....	
		eL_N	7 54 15	.....	.....	.....	.....	
		M_N	8 13 44	16	.....	*440	.....	
		C_N	8 19 ..	.....	.....	.....	.....	
		F_N	10 22 ..	.....	.....	.....	.....	

* Trace amplitude.

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.

1919.			*H. m. s.*	*Sec.*	*μ*	*μ*	*km.*	
Apr. 5	.....	.....	.. .. ..	.....	*100	*100	.....	Tremors during the 24 hours preceding 15h on dates given.
6	.....	.....	.. .. ..	.....	*150	*200	.....	
7	.....	.....	.. .. ..	.....	*100	*200	.....	
8	.....	.....	.. .. ..	.....	*50	*50	.....	
11	.....	.....	.. .. ..	.....	*300	*300	.....	
14	.....	.....	.. .. ..	.....	*200	*200	.....	
15	.....	.....	.. .. ..	.....	*100	*100	.....	
18	.....	.....	.. .. ..	.....	*200	*200	.....	
20	.....	.....	.. .. ..	.....	*50	*50	.....	
21	.....	.....	.. .. ..	.....	*50	*50	.....	
25	.....	.....	.. .. ..	.....	*250	*300	.....	
26	.....	.....	.. .. ..	.....	*50	*100	.....	
30	.....	.....	.. .. ..	.....	*50	*50	.....	

* Trace amplitude.

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′ 35″ N.; long., 104° 56′ 54″ W. Elevation, 1,655 meters.

Instrument: Wiechert 80 kg., astatic, horizontal pendulum.

1919.			*H. m. s.*	*Sec.*	*μ*	*μ*	*km.*	
Apr. 3	.....	L_N	1 03 ..	.....	.....	.....	.....	Sinusoidal waves of small amplitude. Large period.
		M_N	1 07 ..	.....	.....	.....	.....	
		F_N	1 12 ..	.....	.....	.....	.....	
5	.....	L_N	1 08 ..	.....	.....	.....	.....	Irregular sinusoidal.
		F_N	1 15 ..	.....	.....	.....	.....	
17	.....	L.....	21 03 ..	.....	.....	.....	.....	Very distinct. P not discernible.
		M_N	21 04 ..	.....	.....	.....	.....	
		M_E	21 11 ..	.....	.....	.....	.....	
		F_E	21 22 ..	.....	.....	.....	.....	
		F_N	21 24 ..	.....	.....	.....	.....	
18	.....	P_E	22 08 ..	.....	.....	.....	.....	P not discernible on N-S.
		L.....	22 11 ..	9–10	*500	*5,500	.....	
		M_E	22 13 ..	.....	*5,500	.....	.....	
		M_N	22 14 ..	.....	.....	*5,500	.....	
		F.....	22 22 ..	.....	.....	.....	.....	
30	.....	P.....	7 39 ..	.....	.....	.....	.....	
		S_N	7 45 30	.....	.....	.....	.....	S_E obscured by time marks.
		L_E	7 57 ..	15	*3,000	.....	.....	
		L_N	7 59 ..	15	.....	*2,100	.....	
		M.....	8 08 ..	20–21	*3,000	*2,100	.....	
		F_E	9 11 ..	.....	.....	.....	.....	
		F_N	9 12 ..	.....	.....	.....	.....	

*Trace amplitude.

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, T₀ 6.4

1919.			*H. m. s.*	*Sec.*	*μ*	*μ*	*km.*	
Apr. 2	.....	IP.....	0 54 38	.....	.....	.....	8,950	P very sharply defined on N-S. Other phases not discernible.
		S_E	1 04 46	.....	.....	.....	.....	
		F.....	1 30 ..	.....	.....	.....	.....	
17	.....	P_E	11 42 10	.....	.....	.....	3,810	
		SN?	11 47 46	.....	.....	.....	.....	
		L.....	11 51 40	.....	.....	.....	.....	
		F.....	13 55 ..	.....	.....	.....	.....	
17	.....	P.....	20 58 51	.....	.....	.....	2,050	
		S.....	21 02 19	.....	.....	.....	.....	
		L.....	21 03 40	24	.....	.....	.....	
		M.....	21 08 45	.....	*7,500	*7,500	.....	Movement dies out on E-W much sooner than on N-S.
		L.....	21 16 00	16	.....	.....	.....	
		F.....	22 30 ..	.....	.....	.....	.....	
18	.....	P.....	21 07 34	.....	.....	.....	3,600	
		S.....	21 12 58	.....	.....	.....	.....	
		L?.....	21 16 28	.....	.....	.....	.....	
		M_N	21 50 00	.....	.....	*6,000	.....	
		F.....	22 20 00	.....	.....	.....	.....	
19	.....	P?.....	3 02 42	.....	.....	.....	.....	No L waves visible
		S?.....	3 08 10	.....	.....	.....	.....	
		F.....	3 35 ..	.....	.....	.....	.....	
21	.....	P.....	11 34 38	.....	.....	.....	4,890	
		S.....	11 41 14	.....	.....	.....	.....	
		L.....	11 47 50	20	.....	.....	.....	
		F.....	12 30 ..	.....	.....	.....	.....	
21	.....	eL_N	15 54 50	18	.....	.....	.....	
		F.....	16 02 00	.....	.....	.....	.....	
27	.....	P?.....	0 42 53	.....	.....	.....	.....	Record indistinct.
		eL.....	1 35 00	.....	.....	.....	.....	
		L.....	1 41 00	16	.....	.....	.....	
		F.....	1 55 00	.....	.....	.....	.....	
28	.....	P.....	6 51 52	.....	.....	.....	2,930	Salvador.
		S.....	6 56 30	.....	.....	.....	.....	
		L?.....	6 58 45	.....	.....	.....	.....	
		L.....	7 03 30	12	.....	.....	.....	
		F.....	7 35 00	.....	.....	.....	.....	
30	.....	P.....	7 31 29	.....	.....	.....	9,850	Large record, but difficult of interpretation.
		S?.....	7 42 20	.....	.....	.....	.....	
		L.....	8 01 25	60	.....	.....	.....	
		L.....	8 10 ..	20	.....	.....	.....	
		L.....	8 27 ..	16	.....	.....	.....	
		F.....	11 40 ..	.....	.....	.....	.....	

*Trace amplitude.

TABLE 2.—*Instrumental seismological reports, April, 1919*—Continued.

District of Columbia. *Washington. Georgetown University.* F. A. 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	0
	N	143	5.2	0
	Z	*80*	*3.0*	*0*

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	*μ.*	*μ.*	*km.*	
Apr. 17	.....	eP_E	11 41 24	.....	.....	.....	.....	Not shown on N-S. Sheets changed at 13h 09m, quake still going on.
		S_E?	11 52 08	.....	.....	.....	.....	
		L_E	12 03 27	22	.....	.....	.....	
		L_E	12 18 ..	22	.....	.....	.....	
17	.....	eP_E	20 58 52	.....	.....	.....	.....	
		eP_N	20 58 53	.....	.....	.....	.....	
		S	21 03 38	.....	.....	.....	.....	
		eL_E?	21 05 30	.....	.....	.....	.....	
		M_E	21 08 38	6	*1,900	.....	.....	
		M_E	21 09 21	6	*1,500	.....	.....	
		M_E	21 10 00	6	*1,700	.....	.....	
		M_N	21 12 02	14	.....	*1,600	.....	
		F	22 15 ..	.....	.....	.....	.....	
18	.....	eP_E	21 07 30	.....	.....	.....	.....	P_N hardly shows. Microseisms present.
		S	21 13 00	.....	.....	.....	.....	
		eL	21 16 00	6	.....	.....	.....	
		L_N	21 18 57	19	.....	.....	.....	
		L_E	21 19 10	16	.....	.....	.....	
		M_N	21 20 03	11	.....	*800	.....	
		M_E	21 20 31	.....	*900	.....	.....	
		F	22 20 ..	.....	.....	.....	.....	F difficult.
19	.....	L_E	3 21 13	.....	.....	.....	.....	No other phases discernible. Microseisms present.
			3 25 ..					
21	.....	P_E	11 34 34	.....	.....	.....	.....	N-S poorly defined.
		S	11 41 12	.....	.....	.....	.....	
		eL_E	11 47 ..	38	.....	.....	.....	F lost in changing sheets.
28	.....	eP	6 51 45	.....	.....	.....	.....	eP poorly defined on N-S.
		S_E?	6 56 25	.....	.....	.....	.....	
		eL_E	7 01 12	16	.....	.....	.....	
		F	7 30 ..	.....	.....	.....	.....	
30	.....	eP	7 31 20	.....	.....	.....	.....	eP and other phases poorly defined on N-S. Vertical component poorly defined.
		PR!	7 35 53	.....	.....	.....	.....	
		S_E	7 42 20	.....	.....	.....	.....	
		S_E?	7 42 23	.....	.....	.....	.....	
		eL_E	8 01 06	22	.....	.....	.....	
		M_E	8 17 53	19	*5,200	.....	.....	
		M_N	8 20 18	16	.....	*1,800	.....	
		M_E	8 20 20	19	*4,400	.....	.....	
		M_E	8 24 20	16	*3,800	.....	.....	
		F	13 23 ..	.....	.....	.....	.....	

* Trace amplitude.

Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Frank Neumann.

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 18.1. Sensitiveness 0.40 arc tilt=1 mm.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	*μ*	*μ*	*km.*	
Apr. 17	.....	P	11 31 48	.....	.....	.....	.....	
		S	11 38 24	18	.....	.....	.....	
		L	11 49 00	22	.....	.....	.....	
		M	11 54 54	19	*2,000	.....	.....	
		C	12 03 ..	17	.....	.....	.....	
		F	14 45 ..	.....	.....	.....	.....	
17	.....	P	21 03 54	19	.....	.....	.....	
		S	21 12 30	18	.....	.....	.....	
		L	21 23 30	18	.....	.....	.....	
		M	21 26 06	20	*4,000	.....	.....	
		C	21 43 ..	18	.....	.....	.....	
		F	23 03 ..	.....	.....	.....	.....	
18	.....	P	21 21 48	.....	.....	.....	.....	Probably local.
		M	21 27 06	15	*900	.....	.....	
		F	22 45 ..	.....	.....	.....	.....	
21	.....	L	13 40 48	19	.....	.....	.....	
		M	13 45 00	.....	*100	.....	.....	
		F	14 06 ..	.....	.....	.....	.....	
22	.....	P	3 01 30	18	.....	.....	.....	
		L	3 10 06	21	.....	.....	.....	
		M	3 16 30	22	*300	.....	.....	
		C	3 21 ..	20	.....	.....	.....	
		F	4 12 ..	.....	.....	.....	.....	
23	.....	P	7 21 12	19	.....	.....	.....	
		S or L	7 24 06	.....	.....	.....	.....	
		M	7 24 48	.....	*500	.....	.....	
		M	7 47 ..	.....	*500	.....	.....	
		F	8 00 ..	.....	.....	.....	.....	
27	.....	L	0 46 ..	19	.....	.....	.....	
		M	1 16 30	17	*700	.....	.....	
		C	1 20 30	.....	.....	.....	.....	
		F	1 35 ..	.....	.....	.....	.....	
28	.....	L	7 17 ..	21	.....	.....	.....	
		M	7 22 30	.....	*300	.....	.....	
		F	7 38 ..	.....	.....	.....	.....	
30	.....	P	7 26 00	.....	.....	.....	.....	The times given for S and L refer to points of marked increase of amplitude.
		S	7 32 24	.....	.....	.....	.....	
		L	7 35 42	19	.....	.....	.....	
		M	7 41 30	.....	*35,000	.....	.....	
		F	13 02 ..	.....	.....	.....	.....	

* Trace amplitude.

TABLE 2.—*Instrumental seismological reports, April, 1919*—Continued.

Illinois. *Chicago.* University of Chicago. U. S. Weather Bureau.

Lat., 41° 47′ N.; long., 87° 37′ W. Elevation, 180.1 meters.

Instruments: Two Milne-Shaw horizontal pendulums, 0.45 kg.

Instrumental constants..		V	T_0	e	Sensitivity.
	E	150	12	20:1	1″ arc tilt=26.6 mm.
	N	150	8	20:1	1″ arc tilt=13.2 mm.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*km.*	
1919. Apr. 2	.....	P.....	0 54 35	.....	.....	.....	.....	S? T_0 of N-S 12s and sensitivity 26.6 until Apr. 21.
		L.....	1 31 00	.....	.....	.....	.....	
		L.....	1 40 30	24	.....	.....	.....	
		L.....	2 22 00	16	.....	.....	.....	
		F.....	3 00 00	.....	.....	.....	.....	
16	.....	L_E.....	4 04 50	24	.....	.....	.....	Record confused in tangled lines on N-S.
		L_E.....	4 13 30	20	.....	.....	.....	
		F.....	4 40 00	.....	.....	.....	.....	
17	.....	P.....	11 41 14	.....	.....	.....	4,175	E-W trace wandered off sheet at 12^h 36^m, record lost for 1 hour. L continues on N-S with about same amplitude for 1½ hours or more.
		S.....	11 47 11	.....	.....	.....	.....	
		L.....	11 50 45	.....	.....	.....	.....	
		L.....	12 12 40	38	.....	.....	.....	
		F.....	14 30 00	.....	.....	.....	.....	
17	.....	P.....	20 58 50	.....	.....	.....	1,970	L waves irregular and continue with uniform period for over 2 hours on both components, though not as large on E-W as on N-S.
		S.....	21 02 10	.....	.....	.....	.....	
		L.....	21 04 30	.....	.....	.....	.....	
		M_N.....	21 05 13	20	.....	120	.....	
		M_N.....	21 13 35	20	.....	100	.....	
18	.....	F.....	0 24 30	.....	.....	.....	.....	
18	.....	P.....	21 07 00	.....	.....	.....	2,960	
		S.....	21 11 40	.....	.....	.....	.....	
		L.....	21 14 43	.....	.....	.....	.....	
		M.....	21 16 00	.....	67	67	.....	
		M_N.....	21 18 00	.....	.....	67	.....	
		F.....	23 20 ..	.....	.....	.....	.....	
19	.....	P.....	3 02 51	.....	.....	.....	3,000	
		S.....	3 07 34	.....	.....	.....	.....	
		L.....	3 13 29	8	.....	.....	.....	
		F.....	4 10 00	.....	.....	.....	.....	
21	.....	P.....	11 35 36	.....	.....	.....	5,925	Record lost after 12^h 45^m, when trace wandered off sheet.
		S.....	11 43 08	.....	.....	.....	.....	
		L.....	11 51 31	26	.....	.....	.....	
21	.....	P.....	15 55 50	15	.....	.....	.....	
		F.....	16 20 ..	.....	.....	.....	.....	
22	.....	P.....	3 03 27	.....	.....	.....	8,430	
		S.....	3 13 09	.....	.....	.....	.....	
		L?	3 26 00	.....	.....	.....	.....	
		L.....	3 31 00	18	.....	.....	.....	
		L.....	3 44 ..	18	.....	.....	.....	
		F.....	5 10 ..	.....	.....	.....	.....	
23	.....	e?.....	7 23 00	.....	.....	.....	.....	
		L.....	7 53 00	.....	.....	.....	.....	
		L.....	8 02 00	16	.....	.....	.....	
		L.....	9 24 ..	24	.....	.....	.....	Possibly Lrepl.
		L.....	9 33 ..	18	.....	.....	.....	
		F.....	9 50 ..	.....	.....	.....	.....	
27	.....	P?.....	0 42 07	.....	.....	.....	.....	P and S doubtful. Instrument adjusted during beginning of quake.
		S.....	0 58 30	.....	.....	.....	.....	
		L.....	1 18 10	.....	.....	.....	.....	
		L.....	1 26 00	28	.....	.....	.....	
		L.....	1 38 ..	17	.....	.....	.....	
		F.....	2 40 ..	.....	.....	.....	.....	
28	.....	P.....	6 51 55	.....	.....	.....	2,940	L waves irregular both as to period and amplitude.
		S.....	6 56 34	.....	.....	.....	.....	
		L.....	6 59 24	.....	.....	.....	.....	
		F.....	8 40 ..	.....	.....	.....	.....	
30	.....	P.....	7 30 52	.....	.....	.....	9,510	
		S.....	7 41 28	.....	.....	.....	.....	
		L.....	7 59 00	50	.....	.....	.....	
		M_E.....	8 09 ..	.....	147	.....	.....	Amplitudes largest on E-W.
		M_E.....	8 13 ..	.....	266	.....	.....	L waves with amplitudes of 67 μ or more continue for nearly 2 hours.
		M_E.....	8 21 ..	.....	420	.....	.....	F in microseisms sometime after 13h.
30	.....	P?.....	7 34 48	.....	.....	.....	.....	All phases confused with preceding quake.
		S?.....	7 45 18	.....	.....	.....	.....	

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..		V	T_0	e
	E	177	3.4	4:1
	N	205	3.4	4:1

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*km.*	
1919. Apr. 17	.....	iP_N.....	20 58 23	.....	.....	.....	.....	S uncertain.
		eP_E.....	20 58 28	.....	.....	.....	.....	
		iL_E.....	21 02 55	.....	.....	.....	.....	
		iL_N.....	21 02 56	.....	.....	.....	.....	
		M_N.....	21 03 23	.....	.....	*3,750	.....	
		M_E.....	21 03 25	.....	*3,200	.....	.....	
		F.....	21 58 ..	.....	.....	.....	.....	
18	.....	eP.....	21 06 04	.....	.....	.....	.....	
		S.....	21 10 14	.....	.....	.....	.....	
		L_E.....	21 13 13	.....	.....	.....	.....	
		L_N.....	21 13 14	.....	.....	.....	.....	
		M_N.....	21 15 15	.....	.....	*4,700	.....	
		M_E.....	21 15 17	.....	*6,250	.....	.....	
		F.....	21 58 ..	.....	.....	.....	.....	
30	.....	P_E.....	7 30 17	.....	.....	.....	.....	
		P_N.....	7 30 19	.....	.....	.....	.....	Corresponding S_N not found. Possibly S_E?. Possibly S_N?.
		S_E?.....	7 34 16?	.....	.....	.....	.....	
		L_E?.....	7 41 09	.....	.....	.....	.....	
		L_N?.....	7 42 02	.....	.....	.....	.....	
		L?.....	8 00 09	.....	.....	.....	.....	
		M_N.....	8 02 25	.....	.....	*1,800	.....	
		M_E.....	8 15 49	.....	*5,000	.....	.....	
		F.....	9 45 ..	.....	.....	.....	.....	

* Trace amplitude.

Maryland. *Cheltenham. Magnetic Ogservatory.* 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..		V	T_0
	E	10	15
	N	10	15

1919			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Apr. 17	.....	P_N.....	20 58 55	3	.....	.....	.....	
		iP_E.....	20 58 58	4	.....	.....	.....	
		iS_N.....	21 03 44	14	.....	.....	.....	
		S_E.....	21 03 48	6	.....	.....	.....	
		L_E.....	21 09 19	16	.....	.....	.....	
		L_N.....	21 09 42	17	.....	.....	.....	
		M_E.....	21 12 21	12	*440	.....	.....	
		M_N.....	21 12 27	15	.....	*1,800	.....	
		C.....	21 16 ..	14	.....	.....	.....	
		F_E.....	21 32 ..	14	.....	.....	.....	
		F_N.....	22 12 ..	13	.....	.....	.....	
18	.....	eP_E.....	21 08 39	.....	.....	.....	.....	
		eP_N.....	21 08 54	.....	.....	.....	.....	
		S_N.....	21 13 13	8	.....	.....	.....	
		L_N.....	21 19 17	.....	.....	.....	.....	L not well marked on E-W.
		L_E.....	21 20 20	.....	.....	.....	.....	
		M.....	21 20 31	13	*20	*570	.....	
		F_E.....	21 33 ..	.....	.....	.....	.....	
		F_N.....	22 07 ..	.....	.....	.....	.....	
28	.....	eP_N.....	6 51 54	.....	.....	.....	.....	
		eP_E.....	6 51 59	.....	.....	.....	.....	
		L_N.....	7 00 59	.....	.....	.....	.....	
		M_N.....	7 03 44	.....	.....	*30	.....	
		F_E.....	7 07 ..	.....	.....	.....	.....	
		C_N.....	7 13 ..	.....	.....	.....	.....	
		F_N.....	7 27 ..	.....	.....	.....	.....	
30	.....	e_E.....	7 34 33	.....	.....	.....	.....	Early phases not well defined. iP_E may be PR.
		iP_E.....	7 35 51	4	.....	.....	.....	
		eP_N.....	7 35 54	4	.....	.....	.....	
		eS_N.....	7 44 00	10	.....	.....	.....	Possibly SR_N. at 7^h 51^m, 26^s.
		L_E.....	8 11 47	19	.....	.....	.....	
		eL_N.....	8 17 ..	.....	.....	.....	.....	
		M_N.....	8 22 31	14	.....	*1,580	.....	
		M_E.....	8 24 41	15	*1,700	.....	.....	
		C.....	8 56 ..	15	.....	.....	.....	
		F_E.....	10 13 ..	16	.....	.....	.....	
		F_N.....	10 58 16	.....	.....	.....	.....	

*Trace amplitude.

TABLE 2.—*Instrumental seismological reports, April, 1919*—Continued.

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

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

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

Instrumental constants.. V T_0 ϵ; E 80 23 0; N 50 25 4:1

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Apr. 2	.....	e.....	1 52 29	8	.....	.....	.....	Cf. Ottawa, eL 1h 46m.
		L_N....	1 55 30	20	.....	.....	.....	Slight record on N-S.
		F.....	2 04 02	.....	.....	.....	.....	
15	.....	M_N?...	17 36 34 / 17 38 00	28 / 24	.....	.....	.....	Possibly not seismic; among irregular waves running from 13h 57m to 21h 30m.
16	.....	L_N....	3 59 52	20	.....	.....	.....	Cf. Ottawa eL 4h.
		L.....	4 12 40	18	.....	.....	.....	
		L.....	4 19 36	16	.....	.....	.....	
		F?....	4 20 50	.....	.....	.....	.....	
17	.....	*O*?....	*11 28* ..	.....	.....	.....	7,350*	Distance may be as much 8.050 km. Minute ticks failed during registration of P. Changed E-W record before 11h 55m.
		P_N?...	11 49 19	.....	.....	.....	.....	
		S_N?...	11 58 41	.....	.....	.....	.....	
		S_E....	11 59 46	.....	.....	.....	.....	
		eL_N...	12 12 42	64	.....	.....	.....	
		L_E....	12 20 41	32	.....	.....	.....	
		L.....	12 27 43	22.5	.....	.....	.....	Not Lrep.
		M_E....	12 27 53	20	.....	.....	.....	
		F.....	12 53 ..	.....	.....	.....	.....	
17	.....	*O*.....	*20 53 13*	.....	.....	.....	3,350	E-W gives distance 3,450 km.
		iP_N....	20 59 42	4	.....	.....	.....	
		iP_E....	20 59 43	4	.....	.....	.....	
		S_N....	21 04 49	.....	.....	.....	.....	
		S_E....	21 04 57	12	.....	.....	.....	
		i_N....	21 09 53	.....	.....	.....	.....	Large waves like L.
		L.....	21 10 29	26	.....	.....	.....	
		M_N....	21 12 31	.....	.....	.....	.....	
		M_E....	21 13 24	17	*29,000	.....	.....	
		M_N....	21 14 25	.....	.....	.....	.....	
		M_E....	21 15 26	17	*63,000	.....	.....	
		M_N....	22 23 45 / 22 35 50	.....	.....	.....	.....	A lenticular group of waves. E-W styles off drum from 22h 15m 42s to 22h 16m 48s. Automatic gong rang during occurrence of M.
		F.....	23 34 ..	.....	.....	.....	.....	
18	.....	*O*.....	*21 01 00*	.....	.....	.....	4,120	Cf. Ottawa, *O* 21h 01m 02s.
		P_E....	21 08 27	3	.....	.....	.....	
		i_N....	21 09 53	6	.....	.....	.....	
		i_E....	21 09 55	6	.....	.....	.....	
		S_N....	21 14 21	12	.....	.....	.....	
		S_E....	21 14 28	11	.....	.....	.....	
		L_N....	21 20 04	21	.....	.....	.....	
		L_N....	21 21 33	24	.....	.....	.....	
		L_E....	21 22 48	16	.....	.....	.....	
		M_E....	21 23 10	12	*6,000	.....	.....	Damped 1.5:1.
		M_E....	21 24 47	11	*4,000	.....	.....	
		F.....	22 45 ..	.....	.....	.....	.....	
19	.....	*O*.....	*3 05 50*	.....	.....	.....	3,100	P masked by microseism of 4 sec. period. N-S masked throughout.
		S_E....	3 16 59	6	.....	.....	.....	
		eL_E...	3 19 46	20	.....	.....	.....	
		e_N....	3 20 00	6.5	.....	.....	.....	
		L_E....	3 21 53	20	.....	.....	.....	
		L_E....	3 22 42	15-18	.....	.....	.....	
		L_N....	3 23 38	10	.....	.....	.....	
		F_E....	3 40 ..	.....	.....	.....	.....	
21	.....	*O*.....	*11 26 17*	.....	.....	.....	4,700	42° 18′ of arc.
		P_N....	11 34 25	.....	.....	.....	.....	
		P_E....	11 34 26	.....	.....	.....	.....	
		i_E....	11 35 22	6	.....	.....	.....	
		S_N....	11 40 51	6	.....	.....	.....	
		S_E....	11 40 54	10	.....	.....	.....	

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

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Apr. 21	.....	eL_N?..	11 45 11	24	.....	.....	.....	
		eL_E?..	11 45 26	15	.....	.....	.....	Followed by waves of 20 sec. period. F merges into local disturbances peculiar to morning hours.
		F.....	12 22 ..	.....	.....	.....	.....	
		e_N?....	15 51 04	13	.....	.....	.....	Cf. Ottawa, eL 15h 35m.
		e_E....	15 58 36	7	.....	.....	.....	
		L_N....	15 59 44 / 16 01 04	15	.....	*500	.....	
		F_E....	16 14 37	.....	.....	.....	.....	
27	.....	*O*?....	*0 55 45*	.....	.....	.....	7,480	Distance probably greater than given.
		S_N?...	1 15 33	6	.....	.....	.....	
		S_E?....	1 15 47	6	.....	.....	.....	
		e_E....	1 21 58	9	.....	.....	.....	
		e_E....	1 23 31	.....	.....	.....	.....	Amplitude slight.
		L_E....	1 28 38	24	.....	.....	.....	
		L_N....	1 30 34	24	.....	.....	.....	
		L_N....	1 34 19	20	.....	.....	.....	
		F_E....	1 47 30	.....	.....	.....	.....	
28	.....	*O*?....	*6 44 22*	.....	.....	.....	4,420?	P in microseisms.
		e_E....	6 57 24	.....	.....	.....	.....	
		eP_N?..	6 57 55	3.5	.....	.....	.....	
		i_N....	6 58 15	4	.....	.....	.....	
		S_N?...	6 58 21	6	.....	.....	.....	
		i_N....	6 59 16	.....	.....	.....	.....	Pendulum shifted north.
		eL_E...	7 03 44	18	.....	.....	.....	
		eL_N...	7 03 59	16	.....	.....	.....	
		L_N....	7 06 11	22	.....	.....	.....	
		L_N....	7 06 33	15	.....	.....	.....	
		F.....	7 49 40	.....	.....	.....	.....	
28	.....	L_N....	11 32 00 / 11 34 06	20	.....	.....	.....	Amidst irregular waves of long periods; less distinct on E-W.
30	.....	*O*.....	*7 18 10*	.....	.....	.....	10,390	93.°5 of arc. Cf. La Paz, *07h 18m 20s*; distance, 9,550 km. Harvard and La Paz give intersection in longitude 158.5°.
		eP_E...	7 31 31	4	.....	.....	.....	
		P_N....	7 32 20	4	.....	.....	.....	
		#P_NR_1	7 36 18	3	.....	.....	.....	
		#P_ER_1	7 36 29	3.5	.....	.....	.....	
		P_ER_2..	7 37 18	7	.....	.....	.....	
		P_NR_2..	7 37 45	6.5	.....	.....	.....	
		S_N....	7 42 50	.....	.....	.....	.....	
		S_E....	7 42 56	.....	.....	.....	.....	
		#i_N....	7 44 14	19	.....	.....	.....	
		#i_E....	7 46 05	18	.....	.....	.....	
		S_ER_1..	7 47 00	.....	.....	.....	.....	E-W damped 1.5:1 by magnet.
		S_NR_1..	7 48 00	16	.....	.....	.....	Looks like eL of a superposed second quake. i_N 7h 44m 14s looks like iS of a second quake. Times marked # fit into a supposed quake, distance 6,370 km.
		#$P-P_N$	7 52 10	47	.....	.....	.....	
		S_NR_2..	7 53 00	.....	.....	.....	.....	
		i_E....	7 59 30	.....	.....	.....	.....	
		#i_N....	8 00 00	.....	.....	.....	.....	
		eL_N...	8 02 42	49	.....	.....	.....	
		L_N....	8 05 10	53.5	.....	.....	.....	
		L_E....	8 05 13	20	.....	.....	.....	
		M_N....	8 17 23	18	.....	*61,500	.....	
		M_E....	8 18 45	15	*60,000	.....	.....	
		M_E....	8 20 30	.....	.....	.....	.....	
		M_E....	8 21 00	.....	.....	.....	.....	*O* 7 26 26 iP_N 7 36 18 S_N 7 44 19 eL_N 7 52 10 M 8 00 ..
		M_N....	8 21 36	.....	.....	.....	.....	N-S stylus left drum and no further record on N-S. These maxima with a period of about 15 sec. and average trace amplitude of *60,000 μ continue until 8h 47m. The damping is too slight.
		M_E....	8 22 00	.....	.....	.....	.....	
		M_E....	8 24 00	.....	.....	.....	.....	
		C_E....	9 19 ..	.....	.....	.....	.....	
		Lrepi..	9 37 00	.....	.....	.....	.....	
		M.....	9 38 ..	.....	.....	.....	.....	
		M.....	9 39 ..	.....	.....	.....	.....	
		Lrepi..	11 10 ..	.....	.....	.....	.....	
		Lrepi..	12 32 ..	.....	.....	.....	.....	F may be later, record changed.
		F.....	12 37 ..	.....	.....	.....	.....	

*Trace amplitude.

TABLE 2.—*Instrumental seismological reports, April, 1919*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

Missouri. *Saint 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: 1 feet of tough clay over limestone of Mississippi system, about 300 feet thick.

Instrument: Wiechert 80 kg. astatic, horizontal pendulum.

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

(Report for April, 1919, not received.)

New York. *Ithaca. Cornell University.* Heinrich Ries.

Lat., 42° 26′ 58″ N.; long., 76° 29′ 09″ W. Elevation, 242.6 meters.

Instruments: Two Bosch-Omori, 25 kg., horizontal pendulums (mechanical registration).

Instrumental constants..	V	T_0	ε
E	13	22	4:1
N	14	25	4:1

1919.			H. m. s.	Sec.	μ	μ	km.
Apr. 17	.....	e_E	11 47 18	4	.....	.....	.....
		e_E	11 51 21	4	.....	.....	.....
		e_N	11 51 25	4	.....	.....	.....
		S_E	11 57 54	20	.....	.....	.....
		S_N	11 58 18	18	.....	.....	.....
		L_N	12 12 20	45	.....	.....	.....
		L_E	12 15 20	30	.....	.....	.....
		L	13 24 ..	.....	.....	.....	.....
		F_E	14 06 ..	.....	.....	.....	.....
17	.....	P_N	20 59 01	5	.....	.....	.....
		S_E	21 04 19	9	.....	.....	.....
		M_N	21 12 45	17	.....	*3,800	.....
		F_E	22 22 ..	.....	.....	.....	.....
18	.....	ePe_E	21 08 46	7	.....	.....	.....
		ePe_N	21 08 53	5	.....	.....	.....
		eS_N	21 13 21	8	.....	.....	.....
		e_N	21 16 18	7	.....	.....	.....
		L_N	21 19 48	15	.....	.....	.....
		F_E	22 12 ..	.....	.....	.....	.....
21	.....	P_E	11 34 31	4	.....	.....	.....
		P_N	11 34 33	4	.....	.....	.....
		e	11 37 35	5	.....	.....	.....
		S_E?	11 41 21	12	.....	.....	.....
		S_E?	11 41 23	5	.....	.....	.....
		L_N	11 47 19	12	.....	.....	.....
		L_E	11 47 21	9	.....	.....	.....
		F	12 20 ..	.....	.....	.....	.....
28	.....	e_E	6 57 55	5	.....	.....	.....
		e_N	6 58 53	6	.....	.....	.....
		L_E	7 01 56	15	.....	.....	.....
		L_N	7 02 36	12	.....	.....	.....
		F_E	7 33 ..	.....	.....	.....	.....
30	.....	ePe_E	7 31 24	5	.....	.....	.....
		PR_1	7 35 19	5	.....	.....	.....
		S_E	7 42 21	9	.....	.....	.....
		S_N	7 43 16	8	.....	.....	.....
		L_N	8 01 16	60	.....	.....	.....
		M_E	8 24 56	16	*5,700	.....	.....
		F_E	12 08 ..	.....	.....	.....	.....

* Trace amplitude.

New York. *New York. Fordham University.* D. H. Sullivan, S. J.

Lat., 40° 51′ 47″ N.; long., 73° 53′ 08″ W. Elevation, 23.9 meters.

Instrument: Wiechert, 80 kg.

Instrumental constants..	V	T_0	ε
E	72	5.0	0
N	72	5.0	0

(Report for April, 1919, not received.)

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

Panama Canal Zone. *Balboa Heights.* Governor, Panama Canal.

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

Instruments: Two Bosch-Omori, 100 kg.

Instrumental constants..	V	T_0
	35	20

1919.			H. m. s.	Sec.	μ	μ	km.	
Apr. 17	.....	P_E	20 56 11	.....	.....	.....	1,130	
		P_N	20 56 12	.....	.....	.....	.....	
		S_N	20 58 34	.....	.....	.....	.....	
		S_E	20 58 51	.....	.....	.....	.....	
		L_N	20 59 26	.....	.....	.....	.....	
		L_E	20 59 55	.....	.....	.....	.....	
		M_E	21 01 20	.....	*900	.....	.....	
		M_N	21 01 38	.....	.....	*1,800	.....	
		F	21 28 00	.....	.....	.....	.....	
28	.....	P_E	6 48 22	.....	.....	.....	.....	San Salvador.
		P_N	6 48 27	.....	.....	.....	.....	
		S_E	6 49 53	.....	.....	.....	.....	
		L_N	6 51 09	.....	.....	.....	.....	
		M_N	6 53 37	.....	.....	*500	.....	
		F	7 15 00	.....	.....	.....	.....	
30	.....	P_N	7 30 40	.....	.....	.....	10,400	
		P_E	7 30 45	.....	.....	.....	.....	
		S_E	7 41 49	.....	.....	.....	.....	
		S_N	7 42 00	.....	.....	.....	.....	
		L_N	7 57 00	.....	.....	.....	.....	
		L_E	8 02 20	.....	.....	.....	.....	
		M_E	8 18 00	.....	*2,000	.....	.....	
		M_N	8 18 30	.....	.....	*2,000	.....	
		F_E	10 03 00	.....	.....	.....	.....	
		F_N	10 15 00	.....	.....	.....	.....	

* Trace amplitude.

Porto Rico. *Vieques. Magnetic Observatory.* U. S. Coast and Geodetic Survey. W. M. Hill.

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

Instruments: Two Bosch-Omori.

Instrumental constants..	V	T_0
E	10	18
N	10	20

1919.			H. m. s.	Sec.	μ	μ	km.	
Apr. 17	.....	ePe_E	20 58 44	7	.....	.....	.....	
		ePe_N	20 59 17	7	.....	.....	.....	
		iS_E	21 03 44	19	.....	.....	.....	
		eS_N	21 04 26	.....	.....	.....	.....	
		L_N	21 06 15	24	.....	.....	.....	
		L_E	21 06 42	19	.....	.....	.....	
		M_N	21 06 45	30	.....	100	.....	
		M_E	21 12 44	14	160	.....	.....	
		C_N	21 17 ..	14	.....	.....	.....	
		C_E	21 19 ..	14	.....	.....	.....	
		F_N	21 29 ..	.....	.....	.....	.....	
		F_E	21 44 ..	.....	.....	.....	.....	
21	.....	eP_E	11 31 35	9	.....	.....	.....	
		eP_N	11 31 43	.....	.....	.....	.....	
		eS_E	11 35 30	10	.....	.....	.....	
		eS_N	11 36 12	.....	.....	.....	.....	
		eL_E	11 37 35	.....	.....	.....	.....	
		M_E	11 42 40	8	10	.....	.....	
		M_N	11 43 25	7	.....	.....	.....	
		F_E	11 59 ..	.....	.....	.....	.....	
		F_N	12 01 ..	.....	.....	.....	.....	
28	.....	eP_E	6 55 32	.....	.....	.....	.....	
		eL_E	6 58 53	.....	.....	.....	.....	
		M_E	7 01 48	11	10	.....	.....	
		F_E	7 11 ..	.....	.....	.....	.....	
30	.....	eP_N	7 35 31	7	.....	.....	.....	This may be PR.
		eP_E	7 36 31	8	.....	.....	.....	
		S_E	7 46 13	.....	.....	.....	.....	
		S_ER	7 52 28	.....	.....	.....	.....	
		S_NR	7 52 45	.....	.....	.....	.....	
		eL_N	8 03 ..	38	.....	.....	.....	
		L_E	8 12 27	22	.....	.....	.....	
		L_N	8 14 50	.....	.....	.....	.....	
		M_N	8 16 25	18	.....	120	.....	
		M_E	8 31 17	17	180	.....	.....	
		F_N	9 55 ..	.....	.....	.....	.....	
		F_E	10 29 ..	.....	.....	.....	.....	

TABLE 2.—*Instrumental seismological reports, April, 1919*—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.. V: E 10, N 10; T_0: E 15, N 16

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Apr. 17	.....	e.....	20 58 53	.....	.....	.....	.....	
		S?.....	21 01 24	.....	.....	.....	.....	
		L.....	21 05 00	20	.....	.....	.....	
		L.....	21 11 36	20	.....	.....	.....	
		M_N.....	21 16 00	16	*10,000	.....	.....	
		F.....	22 10 00	.....	.....	.....	.....	
18	.....	e.....	21 14 25	.....	.....	.....	.....	
		L.....	21 54 00	14	.....	.....	.....	
		F.....	22 00 ..	.....	.....	.....	.....	
21	.....	.....	.....	.....	.....	.....	.....	Trace on N–S about $11^h\ 45^m$ but no time marks.
28	.....	eL_E.....	7 00 00	.....	.....	.....	.....	Does not show on N–S.
		L_E.....	7 04 00	12	.....	.....	.....	
		F.....	7 20 ..	.....	.....	.....	.....	
30	.....	e.....	7 35 53	.....	.....	.....	.....	All phases indistinct.
		L.....	8 12 00	24	.....	.....	.....	
		L.....	8 17 00	18	.....	.....	.....	L continues more or less irregular for over ½ hour, largest on E–W.
		F.....	11 00 ..	.....	.....	.....	.....	

* Trace amplitude.

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.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Apr. 2	.....	e?.....	0 57 22	.....	.....	.....	.....	e, irregular, may be local.
		eL.....	1 45 .. to 2 05 ..	26	.....	.....	.....	eL are regular sinusoidal waves of small amplitude.
16	.....	eL.....	4 00 .. to 4 20 ..	15	.....	.....	.....	Very small amplitude. Barely discernible.
17	.....	*O*.....	*11 28 35*	.....	.....	.....	9,760	
		P?.....	11 41 25	.....	.....	.....	.....	
		S_E?.....	11 52 12	.....	.....	.....	.....	
		L.....	12 11 54	48	.....	.....	.....	
		L.....	12 20 ..	36	.....	.....	.....	
		L.....	12 35 ..	16	.....	.....	.....	
		L.....	13 05 ..	16	.....	.....	.....	
		L.....	13 30 ..	22	.....	.....	.....	F 14^h.
17	.....	*O*.....	*20 58 02*	.....	.....	.....	3,590	
		iP.....	20 59 49	.....	.....	.....	.....	
		eS.....	21 05 12	.....	.....	.....	.....	
		eL?...	21 08 30	.....	.....	.....	.....	
		M.....	21 15 ..	17	.....	.....	.....	
		L.....	21 36 ..	15	.....	.....	.....	
		L.....	21 55 ..	14	.....	.....	.....	
		F.....	22 30 ..	.....	.....	.....	.....	

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

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Apr. 18	.....	*O*.....	*21 01 02*	.....	.....	.....	3,940	
		P.....	21 08 16	.....	.....	.....	.....	
		PR.....	21 09 30	.....	.....	.....	.....	
		S.....	21 14 00	.....	.....	.....	.....	
		eL.....	21 20 18	.....	.....	.....	.....	
		L.....	21 22 ..	8	.....	.....	.....	
		L.....	21 35 ..	8	.....	.....	.....	
		L.....	21 43 ..	8	.....	.....	.....	
		L.....	22 06 ..	8	.....	.....	.....	
		F.....	22 30 ..	.....	.....	.....	.....	
19	.....	iS.....	3 09 38	.....	.....	.....	.....	P lost in microseisms.
		L.....	3 19 30 to 3 33 ..	8	.....	.....	.....	eL?.
		F.....	3 50 ..	.....	.....	.....	.....	
21	.....	eL.....	15 55 .. to 16 10 ..	17	.....	.....	.....	
22	.....	eL.....	3 11 .. to 3 25 ..	13	.....	.....	.....	F merges into next quake.
22	.....	eL.....	3 38 .. to 4 05 ..	18	.....	.....	.....	e in preceding quake. Amplitudes very small.
		F.....	4 30 ..	.....	.....	.....	.....	
23	.....	e.....	7 35 ..	.....	.....	.....	.....	
		e.....	7 44 ..	8	.....	.....	.....	
		eL_E..	7 53 ..	36	.....	.....	.....	
		L.....	8 02 ..	?	.....	.....	.....	
		L.....	8 19 ..	?	.....	.....	.....	
		L_E...	8 26 ..	16	.....	.....	.....	
		L_E...	8 32 ..	14	.....	.....	.....	
		F.....	8 45 ..	.....	.....	.....	.....	Record complete up to Apr. 23; next report will be issued about July 1.

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 = 0.45″.

Date.	Character.	Phase.	Time.	Period.	Amplitude. μ	Amplitude. μ	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Apr. 15	.....	L.....	23 41 36	.....	.....	.....	.....	Doubtful as to being seismic.
		M.....	23 43 30	.....	*200	.....	.....	
16	.....	F.....	0 02 36	.....	.....	.....	.....	
16	.....	e.....	4 03 12	.....	.....	.....	.....	
		L.....	4 09 48	.....	*100	.....	.....	
		F.....	4 34 12	.....	.....	.....	.....	
17	.....	P.....	11 40 42?	.....	.....	.....	10,600	Possibly Japan.
		iS.....	11 52 06	.....	.....	.....	.....	
		i.....	12 03 24	.....	.....	.....	.....	
		e.....	12 06 18	.....	.....	.....	.....	
		eL.....	12 30 18	.....	.....	.....	.....	
		M.....	12 32 12	.....	*100	.....	.....	
		eL.....	*13 11 12*	.....	.....	.....	.....	*F merges into next quake.*
17	.....	eL.....	13 36 54	.....	.....	.....	.....	Possibly same origin as preceding. P and S lost in previous quake.
		eL.....	13 42 24	.....	.....	.....	.....	
		M.....	13 43 30	.....	*800	.....	.....	
		iL.....	13 53 36	.....	.....	.....	.....	
		F.....	14 27 48	.....	.....	.....	.....	

TABLE 2.—*Instrumental seismological reports, April, 1919*—Continued.

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

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Apr. 17	.....	P.....	21 00 00	.....	.....	.....	3,810	P not well defined
		iS.....	21 05 36	.....	.....	.....	.....	S of large amplitude.
		iL.....	21 07 42	.....	.....	.....	.....	
		iL.....	21 11 42	.....	.....	.....	.....	
		iL.....	21 17 42	.....	.....	.....	.....	
		M.....	21 19 24	.....	*8,500	.....	.....	
		F.....	23 16 36	.....	.....	.....	.....	
18	.....	eS.....	21 15 48	.....	.....	.....	.....	
		L.....	21 20 48	.....	.....	.....	.....	
		M.....	21 21 30	.....	*800	.....	.....	
		L.....	21 27 06	.....	.....	.....	.....	
		F.....	22 01 42	.....	.....	.....	.....	
19	.....	L.....	3 12 42?	.....	.....	.....	.....	Barely noticeable.
		L.....	3 38 18	.....	.....	.....	.....	
21	.....	L.....	11 43 42	.....	.....	.....	.....	
		eL.....	11 59 30	.....	.....	.....	.....	
		M.....	12 01 06	.....	*300	.....	.....	
		F.....	12 44 30	.....	.....	.....	.....	Light off at 15h when other stations record quake.
22	.....	L.....	3 24 42	.....	.....	.....	.....	
		L.....	3 53 24	.....	*100	.....	.....	
		L.....	3 56 30	.....	.....	.....	.....	
22	.....	.....	.....	.....	.....	.....	.....	Marked microseisms at 5h 31m 18s, amplitude *200.
23	.....	L.....	8 05 30	.....	*50	.....	.....	
		F.....	8 29 06	.....	.....	.....	.....	
27	.....	e.....	*1 25 18*	.....	.....	.....	.....	
		eL.....	1 33 54	.....	.....	.....	.....	
		M.....	1 41 36	.....	*100	.....	.....	
		F.....	2 25 18	.....	.....	.....	.....	
28	.....	*S?.....	*7 00 00*	.....	.....	.....	.....	San Salvador, P not recorded.
		iL.....	7 04 06	.....	.....	.....	.....	
		M.....	7 04 30	.....	*800	.....	.....	
		F.....	7 42 18	.....	.....	.....	.....	
30	.....	e.....	7 30 48?	.....	.....	.....	6,790	One of the largest disturbances we have ever recorded.
		eP.....	7 32 00	.....	.....	.....	.....	
		e.....	7 35 18	.....	.....	.....	.....	
		e.....	7 37 00	.....	.....	.....	.....	
		eS.....	7 40 18	.....	.....	.....	.....	
		iL.....	7 44 36	.....	.....	.....	.....	
		iL.....	7 48 00	.....	.....	.....	.....	
		L.....	8 14 00	.....	.....	.....	.....	
		L.....	8 15 30	.....	.....	.....	.....	
		L.....	8 16 30	.....	.....	.....	.....	
		M.....	8 19 00	.....	*25,000	.....	.....	From 8h 17m to 9h 15m a number of swings of very large amplitude.
		L.....	10 15 36	.....	.....	.....	.....	
		F.....	12 39 42	.....	.....	.....	.....	
30	.....	L.....	17 49 00	.....	.....	.....	.....	
		eL.....	17 50 18	.....	.....	.....	.....	
		M.....	17 51 30	.....	*700	.....	.....	
		F.....	18 23 48	.....	.....	.....	.....	

*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 $\frac{T_0}{.18}$. Pillar deviation, 1 mm. swing of boom = 0.54″.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Apr. 16	.....	P.....	4 28 55	.....	.....	.....	.....	
		L.....	4 37 21	.....	.....	.....	.....	
		M.....	4 40 49	.....	*100	.....	.....	
		F.....	4 50 14	.....	.....	.....	.....	
17	.....	P.....	11 35 36	.....	.....	.....	7,500	Japan.
		S.....	11 44 31	.....	.....	.....	.....	
		L.....	12 00 53	.....	.....	.....	.....	
		M.....	12 15 16	.....	*1,200	.....	.....	F merges into next quake.

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

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
Apr. 17	.....	M.....	13 58 12	.....	*400	.....	.....	
		F.....	14 30 03	.....	.....	.....	.....	
17	.....	P.....	21 00 56	.....	.....	.....	4,530	Southern Mexico.
		S.....	21 07 12	.....	.....	.....	.....	
		L.....	21 11 20	.....	.....	.....	.....	
		L.....	21 16 16	.....	.....	.....	.....	
		M.....	21 24 39	.....	*8,500	.....	.....	
		F.....	23 11 45	.....	.....	.....	.....	
			Vertical		A_z			
		*P.....	*21 01 08*	*4*	.....	.....	*3,870*	
		*S.....	*21 06 45*	*8*	.....	.....	.....	
		*L.....	*21 15 27*	*20–24*	.....	.....	.....	
		*M.....	*21 23 43*	*24*	*29*	.....	.....	
18	.....	P.....	21 10 26	.....	.....	.....	1,710	Probably Alaska.
		S.....	21 13 23	.....	.....	.....	.....	
		L.....	21 19 17	.....	.....	.....	.....	
		M.....	21 23 42	.....	*1,500	.....	.....	
19	.....	L.....	3 18 47	.....	.....	.....	.....	
		M.....	3 21 15	.....	*200	.....	.....	
		F.....	3 27 38	.....	.....	.....	.....	
21	.....	L.....	12 03 01	.....	.....	.....	.....	
		M.....	12 13 26	.....	*300	.....	.....	
		F.....	12 55 05	.....	.....	.....	.....	
22	.....	L.....	3 24 42	.....	.....	.....	.....	
		M.....	3 33 33	.....	*200	.....	.....	
		F.....	4 07 00	.....	.....	.....	.....	
23	.....	P?.....	7 47 35	.....	.....	.....	.....	
		L.....	7 58 31	.....	.....	.....	.....	
		M.....	8 05 38	.....	*200	.....	.....	
		F.....	8 20 52	.....	.....	.....	.....	
27	.....	L.....	1 13 48	.....	.....	.....	.....	
		M.....	1 18 43	.....	*200	.....	.....	
		F.....	1 35 55	.....	.....	.....	.....	
28	.....	L.....	7 10 29	.....	.....	.....	.....	
		M.....	7 17 26	.....	*600	.....	.....	
		F.....	7 42 43	.....	.....	.....	.....	
30	.....	P.....	7 20 14	.....	.....	.....	5,750	Probably South America.
		S.....	7 36 37	.....	.....	.....	.....	
		L.....	7 48 54	.....	.....	.....	.....	
		M.....	8 03 11	.....	*34,500	.....	.....	Light off from 16h 43m to 17h 45m when other stations record quake.
		F.....	13 28 15	.....	.....	.....	.....	
			Vertical.		A_z.			
		*P.....	*7 29 00*	*4*	.....	.....	*5,320*	
		*S.....	*7 36 00*	*12*	.....	.....	.....	
		*L.....	*7 53 12*	*24*	.....	.....	.....	
		*M.....	*8 00 30*	*24*	*29*	.....	.....	

*Trace amplitude.

SEISMOLOGICAL DISPATCHES.[1]

Tokyo, Japan, March 29, 1919.

A slight earthquake was felt here to-day at 9:30 a. m. No damage done. (Special observer.)

San Salvador, April 28, 1919.

A violent earthquake occurred in this city at an early hour this morning. Later, about 20 additional shocks were felt, but of lesser violence. (Assoc. Press.)

Washington, D. C., April 29, 1919.

A severe earthquake occurred in San Salvador Monday morning (Apr. 28) at 1 o'clock, causing 40 deaths, injury to many persons, and considerable damage to property. (State Department.)

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

SEISMOLOGY.

W. J. HUMPHREYS, Professor in Charge.

[Dated: Weather Bureau, Washington, D. C., July 2, 1919.]

TABLE 1.—*Noninstrumental earthquake reports, May, 1919.*

Day.	Approximate time, Greenwich civil.	Station.	Approximate latitude.	Approximate longitude.	Intensity Rossi-Forel.	Number of shocks.	Duration.	Sounds.	Remarks.	Observer.
	H. m.	ARIZONA.	° ′	° ′			*M. s.*			
23	11 05	Flagstaff	35 12	111 37	3	1	Few.	None		G. T. Herrington.
		CALIFORNIA.								
2	8 25±	Kennett	40 45	122 24	4	1			Awakened some people	Jos. F. Beattie.
2	8 30	Anderson	40 30	122 22	5	1				Assoc. Press.
		Kennett	40 45	122 24	5	1		Rumbling	Awakened many people	Jos. F. Beattie.
		Redding	40 35	122 25	5	1				Assoc. Press.
2	8 38	Kennett	40 45	122 24	3–4	1				Jos. F. Beattie.
10	7 55	Lone Pine	36 37	118 01	4	2	Few.	None	Windows rattled	G. F. Marsh.
29	20 17	Calexico	32 41	115 30	3	1	½	Rumbling		H. M. Rouse.
		ILLINOIS.								
25	9 45	McLeansboro	38 07	88 33	3	1		Rumbling		A. E. Wilson.
		Mount Carmel	38 25	87 48	4	1		....do		H. W. Seine.
		Olney	38 05	88 07	4	2		....do		J. T. Ratcliffe.
		Springfield	39 48	89 39	3	1			May not be seismic	Mrs. M. W. Draper.
26	13 25½	Cairo	37 00	89 10	3	3	6	None	Windows rattled	U. S. Weather Bureau.
		INDIANA.								
25	9 45	Booneville	38 04	87 16	4				Doors banged	Wm. B. Bethell.
		Evansville	37 58	87 33	3	1		Rumbling		U. S. Weather Bureau.
		Mount Vernon	37 56	87 54	4–5	2		....do	Awakened people	Guy B. Green.
		New Harmony	38 08	85 56	4	1	60	....do	....do	C. P. Wolfe.
		Petersburg	38 31	87 15	3–4	1	50	....do	Shook buildings	David D. Corre.
		Princeton	38 23	87 34	4–5	2	60	....do		R. R. Marshall.
		Vincennes	38 42	87 32	4–5				Awakened many people	Edward Cress.
		Washington	38 40	87 11	4	1	5	None		Chas. C. Feagans.
		KANSAS.								
27	3 06	Wichita	37 41	97 20	4–5	1	4	Rumbling	Furniture moved	U. S. Weather Bureau.
		KENTUCKY.								
23	12 30	Hickman	36 34	89 12	3	1	60	Rumbling		R. A. Johnson.
24	13 30	....do	36 34	89 12	3	1		....do		Do.
25	9 45	Louisville	38 15	85 45	2–3	1	Few.	None	Noticed by people awake	Mrs. J. B. Harris.
		....do	38 15	85 45	2–3	1	10	....do	Awakened people	Dr. G. C. Smith.
		Taylorsville	38 02	85 21	2	1	6	Rumbling		E. S. Speed.
26	13 25	Bardwell	36 52	89 01	2	1	10	....do		Oscar Bodkin.
		Hickman	36 34	89 12	3	1		....do		R. A. Johnson.
28	11 30	....do	36 34	89 12	2	1	30	None		Do.
		MISSOURI.								
26	13 25	New Madrid	36 35	89 32	3	1	Few.	Rumbling		Miss Josie Smith.
		TENNESSEE.								
28	13 45	Tiptonville	36 24	89 30	3	1		None		Lucille Morris.
		UTAH.								
7	23 30	Moroni	39 32	111 30	2–3	1		None	Windows rattled	B. G. Eliason.

TABLE 2.—*Instrumental seismological reports, May, 1919.*

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

[For significance of symbols see REVIEW for January, 1919, p. 59.]

Alabama. *Mobile. Spring Hill College.* Earthquake Station. Cyril Ruhlmann, S. J.

Lat., 30° 41′ 44″ N.; long., 88° 08′ 46″ W. Elevation, 60 meters.

Instrument: Wiechert 80 kg.; astatic, horizontal pendulum.

(No earthquake recorded during May, 1919.)

Alaska. *Sitka. Magnetic Observatory.* U. S. Coast and Geodetic Survey. F. P. Ulrich.

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

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

Instrumental constants.. V: E 10, N 10; T_0: E 17.7, N 16.6

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
May 3	.....	P_E	1 01 08	3	.....	.....	.....	Very slight motion.
		eS_E	1 08 30	.....	.....	.....	.....	
		eS_N	1 08 35	.....	.....	.....	.....	
		eL_E	1 21 00	.....	.....	.....	.....	
		eL_N	1 24 23	.....	.....	.....	.....	
		M_E	1 25 44	15	20	.....	.....	
		M_N	1 26 45	.....	.....	30	.....	
		F_N	1 40 ..	.....	.....	.....	.....	
		F_E	2 07 ..	9	.....	.....	.....	
6	.....	eP_E	20 04 56	.....	.....	.....	.....	Indefinite.
		eP_N	20 06 25	.....	.....	.....	.....	Just one wave.
		L_N	20 20 00	.....	.....	.....	.....	
		L_E	20 20 32	27	.....	.....	.....	L_E well defined.
		M_E	20 23 17	20	40	.....	.....	
		M_N	20 23 26	14	.....	80	.....	
		C_N	20 24 ..	.....	.....	.....	.....	
		C_E	20 28 ..	20	.....	.....	.....	
		F_N	20 40 ..	.....	.....	.....	.....	
		F_E	20 51 ..	18	.....	.....	.....	
18	.....	P_E	9 36 51	.....	.....	.....	.....	Motion on N-S very slight. Felt by a number of people in Sitka. Shook pictures and furniture.
		P_E	9 37 00	.....	.....	.....	.....	
		M_E	9 37 12	.....	60	.....	.....	
		F_N	9 41 30	.....	.....	.....	.....	
		F_E	9 45 00	5	.....	.....	.....	
18	.....	P_N	10 24 14	.....	.....	.....	.....	Felt in Sitka.
		P_E	10 24 26	.....	.....	.....	.....	
		M_E	10 24 52	.....	540	.....	.....	
		M_N	10 24 57	.....	.....	120	.....	
		F_N	10 27 20	.....	.....	.....	.....	
		F_E	10 44 50	6	.....	.....	.....	
20	.....	eP_E	4 27 00	.....	.....	.....	.....	Nothing on N-S.
		eL_E	4 28 00	.....	.....	.....	.....	
		F_E	4 36 ..	.....	.....	.....	.....	

Arizona. *Tucson. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Wm. H. Cullum.

Lat., 32° 14′ 48″ N.; long., 110° 50′ 06″ W. Elevation, 759.6 meters.

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

Instrumental constants.. V: E 10, N 10; T_0: E 14, N 18

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
May 3	.....	eS_N	1 14 15	.....	.....	10	.....	Nothing on E-W.
		F_N	1 42 ..	.....	.....	.....	.....	
6	.....	L_N	20 21 30	37	.....	.....	.....	P and S masked by defective record. Only a faint record on E-W.
		M_N	20 23 20	37	.....	100	.....	
		C_N	20 32 ..	12	.....	.....	.....	
		F_N	21 05 ..	.....	.....	.....	.....	

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.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
May 22	.....	.....	.....	.....	*200	*200	.....	Tremors during 24 hours preceding 15h on date given.

*Amplitude on instrument.

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.

Instrumental constants .....

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
May 3	.....	L_N	1 31 —	.....	.....	.....	.....	P and S not discernible. Weak and irregular on both components.
		L_E	1 35 —	.....	.....	.....	.....	
		C_N	1 36 —	.....	.....	.....	.....	
		C_E	1 42 —	.....	.....	.....	.....	
		F_E	1 50 —	.....	.....	.....	.....	
		F_N	2 00 —	.....	.....	.....	.....	
6	.....	P	20 28 —	.....	.....	.....	.....	Waves on N-S are very weak and indistinct. S? L_N? C_N?
		M_N	20 32 —	.....	.....	*1,000	.....	
		L_E	20 40 —	15	.....	.....	.....	
		M_E	20 41 —	15	*1,000	.....	.....	
		C_E	20 47 —	.....	.....	.....	.....	
		F_E	21 03 —	.....	.....	.....	.....	
		F_E	21 08 —	.....	.....	.....	.....	
31	.....	L_E	12 20 —	.....	.....	.....	.....	Distinct wavelets on E-W.
		F_E	14 04 —	.....	.....	.....	.....	

*Trace amplitude.

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.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
May 1	.....	S_N?	5 59 40	.....	.....	.....	.....	
		L	6 08 30	20	.....	.....	.....	
		L	6 23 —	16	.....	.....	.....	
		F	6 30 —	.....	.....	.....	.....	
2	.....	e	2 57 30	.....	.....	.....	.....	
		L	3 02 30	18	.....	.....	.....	
		L	3 12 —	16	.....	.....	.....	
		F	3 40 —	.....	.....	.....	.....	
3	.....	P	1 05 10	.....	.....	.....	10,110	
		PR_1	1 08 52	.....	.....	.....	.....	
		PR_2	1 10 40	.....	.....	.....	.....	
		S	1 16 13	.....	.....	.....	.....	
		L	1 34 —	40	.....	.....	.....	
		L	1 42 —	20	.....	.....	.....	
		L	1 48 —	16	.....	.....	.....	
		F	3 40 —	.....	.....	.....	.....	
6	.....	eP	20 01 00	.....	.....	.....	10,720	
		S	20 12 30	.....	.....	.....	.....	
		L	20 33 30	40	.....	.....	.....	
		L	20 39 40	18	.....	.....	.....	
		L	20 49 —	20	.....	.....	.....	
		L	21 04 —	16	.....	.....	.....	
		F	22 40 —	.....	.....	.....	.....	
18	.....	e_N	9 56 50	.....	.....	.....	.....	Not on E-W.
		F	10 10 10	.....	.....	.....	.....	
18	.....	e	10 42 10	.....	.....	.....	.....	
		S	10 45 07	.....	.....	.....	.....	
		L?	10 47 10	.....	.....	.....	.....	
		F	11 15 00	.....	.....	.....	.....	
20	.....	P	4 27 10	.....	.....	.....	.....	S not discernible.
		eL	4 40 35	.....	.....	.....	.....	
		F	5 15 00	.....	.....	.....	.....	
22	.....	P	12 03 26	.....	.....	.....	7,175	
		S	12 12 04	.....	.....	.....	.....	
		eL	12 24 45	.....	.....	.....	.....	
		L	12 30 30	16	.....	.....	.....	
		F	12 50 —	.....	.....	.....	.....	

TABLE 2.—*Instrumental seismological reports, May, 1919*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

District of Columbia. *Washington. Georgetown University.* F. A. 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	0
	N	143	5.2	0
	Z	80	3.0	0

1919.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*km.*	
May 1	.....	L_E	6 06 11	20	.....	.....	.....	Does not show on N-S.
	.....	F	6 40 ..	.....	.....	.....	.....	
2	.....	e_E	2 36 19	.....	.....	.....	.....	Microseisms present.
	.....	eL_E	3 02 12	18	.....	.....	.....	
	.....	eL_N?.	3 02 12	18	.....	.....	.....	
	.....	F	3 53 ..	.....	.....	.....	.....	
			Vertical					
	.....	*eL*	*3 01 54*	*24*	.....	.....	.....	
	.....	*F*	*3 55 ..*	.....	.....	.....	.....	
3	.....	eP	1 05 13	.....	.....	.....	.....	Heavy microseisms present.
	.....	P_NR	1 08 57	.....	.....	.....	.....	
	.....	S_N	1 16 13	.....	.....	.....	.....	
	.....	S_E	1 16 16	.....	.....	.....	.....	
	.....	eL_E	1 37 12	27	.....	.....	.....	
	.....	eL_N	1 37 12	11	.....	.....	.....	
	.....	M_E	1 43 10	21	*700	.....	.....	F, 4ª.
			Vertical					
	.....	*tP*	*1 05 04*	.....	.....	.....	.....	
	.....	*t*	*1 08 46*	.....	.....	.....	.....	
	.....	*S*	*1 16 17*	.....	.....	.....	.....	
	.....	*eL*	*1 36 00*	.....	.....	.....	.....	
5	.....	L_E	5 06 11 5 12 ..	27	.....	.....	.....	Does not show on N-S.
6	.....	eP_E	20 00 40	.....	.....	.....	.....	Heavy microseisms present.
	.....	eP_N	20 00 49	.....	.....	.....	.....	
	.....	eS	20 12 33	.....	.....	.....	.....	
	.....	eL_E	20 33 36	27	.....	.....	.....	
	.....	eL_N	20 34 00	22	.....	.....	.....	
	.....	M_N	20 43 41	14	.....	*700	.....	
	.....	M_E	20 51 ..	16	*1,800	.....	.....	F, 23ª.
18	.....	e	10 41 05	.....	.....	.....	.....	
	.....	S	10 45 15	.....	.....	.....	.....	
	.....	eL_E?.	10 47 12	6	.....	.....	.....	
	.....	F	11 50 ..	.....	.....	.....	.....	
20	.....	e_E	4 27 15	.....	.....	.....	.....	
	.....	e_N	4 32 ..	.....	.....	.....	.....	
	.....	e_E	4 32 43	.....	.....	.....	.....	
	.....	eL	4 41 00	14	.....	.....	.....	
	.....	F	4 47 ..	.....	.....	.....	.....	
22	.....	eP_E	12 03 18	.....	.....	.....	.....	Heavy microseisms present.
	.....	ePE	12 03 20	.....	.....	.....	.....	
	.....	S	12 12 01	.....	.....	.....	.....	
	.....	eL	12 30 06	13	.....	.....	.....	F, 13ª.

* Trace amplitude.

Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Frank Neumann.

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 18.4. Sensitiveness 0.40 arc tilt″=1 mm.

1919.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*km.*	
May 1	.....	L	5 46 ..	19	.....	.....	.....	
	.....	M	6 51 12	.....	*400	.....	.....	
	.....	C	7 00 ..	.....	.....	.....	.....	
	.....	F	7 16 ..	.....	.....	.....	.....	
1	.....	L	21 38 ..	18	.....	.....	.....	
	.....	M	21 56 00	.....	*400	.....	.....	
	.....	C	22 02 ..	.....	.....	.....	.....	
	.....	F	22 14 ..	.....	.....	.....	.....	
2	.....	P	2 15 12	19	.....	.....	.....	
	.....	S	2 22 00	.....	.....	.....	.....	
	.....	L	2 25 18	19	.....	.....	.....	
	.....	M	2 34 00	20	*2,500	.....	.....	
	.....	C	2 41 ..	20	.....	.....	.....	Tremors for several hours.

*Trace amplitude.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

Hawaii. *Honolulu. Magnetic Observatory*—Contiuued.

1919.								
			H. m. s.	*Sec.*	μ	μ	*km.*	
May 3	.....	P	1 01 06	20	.....	.....	.....	
	.....	L	1 08 12	20	.....	.....	.....	
	.....	M	1 23 00	21	*12,000	.....	.....	
	.....	C	1 29 ..	.....	.....	.....	.....	
	.....	F	4 20 ..	.....	.....	.....	.....	
4	.....	L	22 58 ..	20	.....	.....	.....	
	.....	M	23 11 30	20	*100	.....	.....	
	.....	F	23 53 ..	.....	.....	.....	.....	
6	.....	P	4 24 00	.....	.....	.....	.....	
	.....	L?	4 27 48	20	.....	.....	.....	
	.....	M	4 37 00	18	*400	.....	.....	
	.....	C	4 43 ..	.....	.....	.....	.....	
	.....	F	5 20 ..	.....	.....	.....	.....	
6	.....	P	19 50 00	20	.....	.....	.....	Pendulum swung off the paper at 20:08:06 from 20:12:48 to 20:14:36 and from 20:16:30 to 20:18:48. Apparently two shocks.
	.....	i	19 56 30	18	.....	.....	.....	
	.....	i	19 59 30	.....	.....	.....	.....	
	.....	L	20 05 30	.....	.....	.....	.....	
	.....	M	20 14 00	18	*17,000	.....	.....	
	.....	C	21 21 ..	.....	.....	.....	.....	
	.....	F	24 47 ..	19	.....	.....	.....	
7	.....	P	5 25 06	17	.....	.....	.....	The two phases (I) may be P and S corresponding to L, judging by the time intervals.
	.....	i	5 32 06	20	.....	.....	.....	
	.....	i	5 38 12	.....	.....	.....	.....	
	.....	L	5 43 24	.....	.....	.....	.....	
	.....	M	5 48 18	19	*4,500	.....	.....	
	.....	C	5 58 ..	.....	.....	.....	.....	
	.....	F	10 03 ..	20	.....	.....	.....	
8	.....	L	5 12 ..	.....	.....	.....	.....	
	.....	M	5 15 30	20	*100	.....	.....	
	.....	F	5 18 ..	.....	.....	.....	.....	
8	.....	P	10 21 54	20	.....	.....	.....	
	.....	iS	10 25 42	20	.....	.....	.....	
	.....	eL	10 30 ..	.....	.....	.....	.....	
	.....	M	10 35 ..	18	*400	.....	.....	
	.....	C	10 40 ..	17	.....	.....	.....	
	.....	F	11 30 ..	20	.....	.....	.....	
8	.....	eL	18 38 ..	.....	.....	.....	.....	
	.....	M	18 43 30	20	*200	.....	.....	
	.....	F	18 49 ..	.....	.....	.....	.....	
8	.....	P	19 25 30	.....	.....	.....	.....	
	.....	eL	19 30 ..	.....	.....	.....	.....	
	.....	M	19 31 18	15	*200	.....	.....	
	.....	C	19 40 ..	20	.....	.....	.....	
	.....	F	21 26 ..	..	.....	.....	.....	A few isolated tremors.
16	.....	eP	1 24 54	18	.....	.....	.....	
	.....	eL	1 38 ..	.....	.....	.....	.....	
	.....	M	1 42 30	19	*100	.....	.....	
	.....	F	1 54	..	.....	.....	.....	
18	.....	L	10 40 30	.....	.....	.....	.....	
	.....	M	10 41 00	19	*100	.....	.....	
	.....	F	10 43 ..	.....	.....	.....	.....	
19	.....	eP	4 19 12	20	.....	.....	.....	
	.....	L	4 25 ..	.....	.....	.....	.....	
	.....	M	4 28 06	.....	*300	.....	.....	
	.....	C	4 31 ..	20	.....	.....	.....	
	.....	F	4 52 17	.....	.....	.....	.....	
20	.....	P	4 33 36	.....	*200	.....	.....	Local tremors; waves irregular.
	.....	F	4 45 ..	20	.....	.....	.....	
22	.....	eP	12 04 42	.....	.....	.....	.....	
	.....	eL	12 08 24	.....	.....	.....	.....	
	.....	M	12 09 54	19	*500	.....	.....	
	.....	C	12 18 ..	.....	.....	.....	.....	
	.....	F	12 55 ..	19	.....	.....	.....	
23	.....	eP	3 39 48	.....	.....	.....	.....	
	.....	eL	3 47 ..	.....	.....	.....	.....	
	.....	M	3 52 06	18	*200	.....	.....	
	.....	F	4 00 ..	18	.....	.....	.....	
27	.....	eP	17 40 24	.....	.....	.....	.....	P is faint. L is obscured by other activity.
	.....	eS	17 45 48	20	.....	.....	.....	
	.....	eL	17 49 30	.....	.....	.....	.....	
	.....	M	17 54 ..	20	*400	.....	.....	
	.....	C	18 04 ..	17	.....	.....	.....	
	.....	F	18 21 ..	20	.....	.....	.....	
28	.....	eP	3 22 ..	.....	.....	.....	.....	
	.....	L	3 25 ..	.....	.....	.....	.....	
	.....	M	3 30 ..	20	*200	.....	.....	
	.....	F	3 54 ..	.....	.....	.....	.....	

*Trace amplitude.

TABLE 2.—*Instrumental seismological reports, May, 1919*—Continued.

Illinois. *Chicago. University of Chicago.* U. S. Weather Bureau.

Lat., 41° 47′ N., long., 87° 37′ W. Elevation, 180.1 meters.

Instruments: Two Milne-Shaw horizontal pendulums, 0.45 kg.

Instrumental constants.. {E 150 12 20:1 1″arc tilt—26.6 mm.; N 150 8 20:1 1″arc tilt—13.2 mm.}

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	*μ*	*μ*	*km.*	
1919. May 1	.....	S?.....	5 59 40	.....	.....	.....	.....	
		L.....	6 08 55	25	.....	.....	.....	
		L.....	6 13 00	18	.....	.....	.....	
		F.....	7 30 ..	.....	.....	.....	.....	
2	.....	P?.....	2 21 14	.....	.....	.....	9,310	
		S.....	2 31 40	.....	.....	.....	.....	
		L.....	2 58 00	25	.....	.....	.....	
		L.....	3 04 ..	18	.....	.....	.....	
		F.....	5 20 ..	.....	.....	.....	.....	
2	.....	P?.....	5 58 06	.....	.....	.....	11,810?	
		S.....	6 10 20	.....	.....	.....	.....	
		L.....	6 32 30	.....	.....	.....	.....	F merges with long period disturbance that continues for hours.
		L.....	7 06 00	18	.....	.....	.....	
2	.....	eL.....	21 01 00	.....	.....	.....	.....	
		L.....	21 10 30	18	.....	.....	.....	
		F.....	21 40 ..	.....	.....	.....	.....	
3	.....	iP.....	1 04 35	.....	.....	.....	9,290	
		PR.....	1 07 54	.....	.....	.....	.....	
		S.....	1 15 00	.....	.....	.....	.....	
		L.....	1 31 42	40	.....	.....	.....	
		L.....	1 47 00	18	.....	.....	.....	Continues with same period and small amplitude for over an hour.
		L.....	2 02 55	18	.....	.....	.....	
		F.....	5 20 ..	.....	.....	.....	.....	
4	.....	P.....	22 58 08	.....	.....	.....	8,740	
		S.....	23 08 05	.....	.....	.....	.....	
		L.....	23 25 00	.....	.....	.....	.....	
		L.....	23 33 00	18	.....	.....	.....	
5	.....	F.....	0 40 ..	.....	.....	.....	.....	
6	.....	S?.....	4 34 33	.....	.....	.....	.....	
		L?.....	4 55 30	.....	.....	.....	.....	
		L.....	5 01 ..	18	.....	.....	.....	
		F.....	6 30 ..	.....	.....	.....	.....	
6	.....	P.....	19 59 20	.....	.....	.....	10,725	
		S.....	20 10 50	.....	.....	.....	.....	
		L.....	20 31 ..	35	.....	.....	.....	
		L.....	20 50 ..	18	.....	.....	.....	
		F.....	23 40 ..	.....	.....	.....	.....	
7	.....	P.....	5 32 46	.....	.....	.....	9,060	
		S.....	5 43 00	.....	.....	.....	.....	
		L.....	6 02 20	.....	.....	.....	.....	
		L.....	6 08 ..	30	.....	.....	.....	
		L.....	6 15 ..	18	.....	.....	.....	
		L.....	6 30 ..	16	.....	.....	.....	Merges into other disturbances at 8b.
8	.....	P?.....	10 19 30	.....	.....	.....	12,810?	
		S.....	10 32 20	.....	.....	.....	.....	
		L.....	10 59 00	18	.....	.....	.....	
		L.....	11 18 00	16	.....	.....	.....	F lost in disturbances after 12b.
8	.....	L?.....	21 21 ..	.....	.....	.....	.....	All phases uncertain.
11	.....	eL.....	10 58 20	.....	.....	.....	.....	
		L.....	11 01 ..	16	.....	.....	.....	
		F.....	11 30 ..	.....	.....	.....	.....	
14	.....	eL.....	4 42 ..	.....	.....	.....	.....	
		F.....	5 10 ..	.....	.....	.....	.....	
18	.....	e.....	9 53 54	.....	.....	.....	.....	
		F.....	10 05 ..	.....	.....	.....	.....	
18	.....	P?.....	10 37 00	.....	.....	.....	1,990?	
		S.....	10 40 22	.....	.....	.....	.....	
		L?.....	10 44 ..	.....	.....	.....	.....	
		F.....	11 30 ..	.....	.....	.....	.....	
18	.....	eL.....	22 44 ..	.....	.....	.....	.....	
		L.....	22 46 20	18	.....	.....	.....	
		L.....	23 00 ..	16	.....	.....	.....	
		F.....	23 20 ..	.....	.....	.....	.....	
19	.....	eL.....	4 45 30	.....	.....	.....	.....	
		L.....	4 47 30	24	.....	.....	.....	
		L.....	4 55 ..	18	.....	.....	.....	
		F.....	5 20 ..	.....	.....	.....	.....	
20	.....	P.....	4 26 23	.....	.....	.....	3,080	
		S.....	4 31 12	.....	.....	.....	.....	
		L.....	4 34 30	.....	.....	.....	.....	
		L.....	4 36 00	16	.....	.....	.....	
		F.....	5 50 ..	.....	.....	.....	.....	

Illinois. *Chicago. University of Chicago*—Continued

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	*μ*	*μ*	*km.*	
1919. May 22	.....	P.....	12 02 47	.....	.....	.....	6,425	N-S component not working.
		S.....	12 10 46	.....	.....	.....	.....	
		L.....	12 20 42	.....	.....	.....	.....	
		L.....	12 25 ..	18	.....	.....	.....	
		L.....	12 44 30	16	.....	.....	.....	
		F.....	15 00 ..	.....	.....	.....	.....	
23	.....	eL.....	6 59 30	.....	.....	.....	.....	
		L.....	7 06 ..	28	.....	.....	.....	
		L.....	7 17 ..	15	.....	.....	.....	
		F.....	8 00 ..	.....	.....	.....	.....	
27	.....	e.....	17 47 24	.....	.....	.....	.....	
		L.....	18 05 20	24	.....	.....	.....	Merges with disturbance that continues for some time.
		F.....	18 40 ..	.....	.....	.....	.....	
28	.....	L.....	3 40 ..	24	.....	.....	.....	
		F.....	4 00 ..	.....	.....	.....	.....	
29	.....	L.....	11 59 ..	24	.....	.....	.....	
		L.....	12 10 ..	15	.....	.....	.....	
		F.....	12 30 ..	.....	.....	.....	.....	

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 ε 4:1; N 205 3.4 4:1}

(Report for May, 1919, not received.)

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 15; N 10 15}

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	*μ*	*μ*	*km.*	
1919. May 3	.....	P_N.....	1 05 14	.....	.....	.....	.....	L and succeeding portions of E–W are barely discernible.
		P_E.....	1 05 25	4	.....	.....	.....	
		S_N.....	1 16 14	.....	.....	.....	.....	
		S_E.....	1 16 19	5	.....	.....	.....	
		eL_N.....	1 38 50	.....	.....	.....	.....	
		eL_E.....	1 42 00	.....	.....	.....	.....	
		M_E.....	1 54 00	15	10	.....	.....	
		M_N.....	1 54 37	16	.....	80	.....	
		C_N.....	2 08 ..	15	.....	.....	.....	
		F_N.....	3 10 ..	.....	.....	.....	.....	
6	.....	ePE.....	20 02 45	.....	.....	.....	.....	
		eP_N.....	20 03 51	.....	.....	.....	.....	
		eL_N.....	20 34 ..	.....	.....	.....	.....	
		eL_E.....	20 36 ..	.....	.....	.....	.....	
		M_N.....	20 50 00	20	.....	170	.....	
		M_E.....	21 01 20	16	40	.....	.....	
		C_E.....	21 11 ..	16	.....	.....	.....	
		C_N.....	21 18 ..	17	.....	.....	.....	
		F_E.....	21 39 ..	16	.....	.....	.....	
		F_N.....	22 17 ..	.....	.....	.....	.....	
18	.....	P_N.....	10 45 12	4	.....	.....	.....	Faint, near-by shock.
		P_E.....	10 45 16	4	.....	.....	.....	
		M_E.....	10 45 40	.....	30	.....	.....	
		M_N.....	10 46 02	.....	.....	30	.....	
		C.....	10 54 ..	.....	.....	.....	.....	
20	.....	eP_N.....	4 36 45	.....	.....	.....	.....	Very faint; nothing on E–W.
		eL_N.....	4 41 ..	.....	.....	.....	.....	
		C.....	4 55 ..	.....	.....	.....	.....	

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.

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

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

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	*μ*	*μ*	*km*	
1919. May 1	.....	O?.....	7 23 54	.....	.....	.....	7,280?	65°31′ of arc. First phase masked by microseisms.
		S_N?.....	7 43 32	6	.....	.....	.....	
		eL_N?.....	7 56 02	40?	.....	.....	.....	
		L_N.....	7 56 44	24	.....	.....	.....	
		L_E.....	8 02 26	25	.....	.....	.....	
		L_N.....	8 03 48	20	.....	.....	.....	
		L_E.....	8 04 37	24	.....	.....	.....	
		M_E?.....	8 07 35	20	.....	.....	.....	
		F.....	8 38 ..	.....	.....	.....	.....	

TABLE 2.—*Instrumental seismological reports, May, 1919*—Continued.

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

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*km.*	
1919. May 2	.....	*O?*	*8 09* ..	.....	.....	.....	10,700	Distance from eL–S
		P_N?	2 22 19	.....	.....	.....	.....	
		S_N?	2 34 29	12	.....	.....	.....	
		i_N	2 36 24	7	.....	.....	.....	
		eL_N	2 56 21	32	.....	.....	.....	
		L_N	2 58 54	18	.....	.....	.....	
		M_N?	3 08 ..	17	.....	.....	.....	
		F	4 38 ..	.....	.....	.....	.....	
3	.....	*O?*	*0 51 55*	.....	.....	.....	10,525?	Distance from eL–P. S phases rather vaguely defined. Possibly begins with PR_1, making distance 11,790 km. and *O*:0h46m 11s. Cf. La Paz, distance 14,260 km *O*:0h 51m.
		eP	1 05 01	3	.....	.....	.....	
		i_N	1 08 37	17	.....	.....	.....	
		i_N	1 15 32	16	.....	.....	.....	
		S_N	1 16 ..	.....	.....	.....	.....	
		eL_N	1 37 44	30	.....	.....	.....	
		L_N	1 38 01	32	.....	.....	.....	
		L_E	1 40 15	24	.....	.....	.....	
		M_N	1 54 ..	.....	.....	.....	.....	
		M_N	1 55 ..	.....	.....	.....	.....	
		F	5 19 ..	.....	.....	.....	.....	
4	.....	L_E	23 42 02	20	.....	.....	.....	No trace on N–S.
		L	23 44 32	18	.....	.....	.....	
5	.....	F	0 10 ..	.....	.....	.....	.....	
6	.....	L_E	7 09 16	20	.....	.....	.....	Not trace on N–S.
		L	7 10 24	18	.....	.....	.....	
		F	7 28 37	.....	.....	.....	.....	
6	.....	*O*	*19 47 19*	.....	.....	.....	10,640	95°/45′ of arc.
		eP_E	20 00 57	.....	.....	.....	.....	
		e_E	20 02 13	6	.....	.....	.....	
		e_N	20 02 33	6	.....	.....	.....	
		S_E	20 12 12	12	.....	.....	.....	
		e_E	20 16 46	15	.....	.....	.....	
		i_N	20 20 07	24	.....	.....	.....	
		i_E	20 20 27	20	.....	.....	.....	
		eL_N	20 33 52	78	.....	.....	.....	
		eL_E	20 33 54	60	.....	.....	.....	
		L	20 36 17	48	.....	.....	.....	
		L	20 37 00	9–15	.....	.....	.....	
		L	20 41 02	35	.....	.....	.....	
		eM_E	20 42 54	18	.....	.....	.....	
		M_E	20 44 46	14	.....	.....	.....	Several maxima from 20h 56m 02s to 21h 17m 25s with periods from 18 to 15 secs.
		C_E	21 29 22	.....	.....	.....	.....	
		F	23 16 30	.....	.....	.....	.....	
7	.....	L_E	11 05 18	20	.....	.....	.....	Indistinct on N–S. eE, 11h.
		F	11 31 ..	.....	.....	.....	.....	
18	.....	*O?*	*8 53* ..	.....	.....	.....	.....	Distance under 2,000 km.
		e_N	8 57 44	2	.....	.....	.....	
		e_E	8 57 59	.....	.....	.....	.....	
		i_N	8 58 29	6	.....	.....	.....	
		L_E	9 01 59	10	.....	.....	.....	
		F	9 05 ..	.....	.....	.....	.....	
18	.....	e_E	10 42 55	.....	.....	.....	.....	*O*? 10h. Distance around 2,000 km. Cf. preceding.
		e_N	10 43 19	.....	.....	.....	.....	
		L_N	10 45 40	.....	.....	.....	.....	
		L_E?	10 45 43	6	.....	.....	.....	
		L_E	10 46 21	8	.....	.....	.....	
		F	11 35 ..	.....	.....	.....	.....	
20	.....	*O?*	*4 31 11*	.....	.....	.....	2,805	25° 13′ of arc.
		$1P_E$	4 36 49	.....	.....	.....	.....	From the west.
		$1P_N$	4 36 59	.....	.....	.....	.....	From the north.
		e_E	4 40 20	6	.....	.....	.....	*O* and distance from L–P.
		e_N	4 41 15	.....	.....	.....	.....	
		e_N	4 41 36	.....	.....	.....	.....	
		eL_E	4 42 29	13	.....	.....	.....	
		eL_N	4 42 31	12	.....	.....	.....	
		M_N	4 45 01	.....	.....	.....	.....	
		M_E	4 45 24	.....	.....	.....	.....	
		C_N	4 45 31	.....	.....	.....	.....	
		F_E	5 15 ..	.....	.....	.....	.....	
22	.....	*O*	*11 58 00*	.....	.....	.....	7,790	70° 16′ of arc. *Changing records* from 12h 09m to 12h 26m.
		P_N	12 03 10	2	.....	.....	.....	
		S_E	12 12 19	8	.....	.....	.....	
		eL_N	12 26 20	20	.....	.....	.....	
		L_E	12 30 06	18	.....	.....	.....	
		L_E	12 33 10	22	.....	.....	.....	
		C_E	12 43 14	10–12	.....	.....	.....	
		F?	13 02 ..	.....	.....	.....	.....	

Missouri. *Saint 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.

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

(Report for May, 1919, not received.)

New York. Ithaca. Cornell University. Heinrich Ries.

Lat., 42° 26′ 58″ N.; long., 76° 29′ 09″ W. Elevation, 242.6 meters.

Instruments: Two, Bosch-Omori, 25 kg., horizontal pendulums (mechanical registration).

		V	T_0	ϵ
Instrumental constants..	E	13	22	4:1
	N	14	25	4:1

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*km.*	
1919. May 1	.....	e_E	6 00 15	4	.....	.....	.....	
		eL_E	6 06 25	23	.....	.....	.....	
		F_E	6 34 —	.....	.....	.....	.....	
2	.....	eL_E	3 01 30	20	.....	.....	.....	
		F_E	4 00 —	.....	.....	.....	.....	
3	.....	P_E	1 04 53	4	.....	.....	.....	
		P_N	1 04 56	4	.....	.....	.....	
		PR_1	1 08 12	5	.....	.....	.....	
		S_N	1 14 49	5	.....	.....	.....	
		S_E	1 15 09	6	.....	.....	.....	
		L_N?	1 25 26	22	.....	.....	.....	
		L_E	*1 31 50*	44	.....	.....	.....	
		F_E	3 54 —	.....	.....	.....	.....	
4	.....	L_E	23 44 20	17	.....	.....	.....	
5	.....	F_E	0 03 —	.....	.....	.....	.....	
6	.....	eP_E	20 01 49	6	.....	.....	.....	
		L	*20 32 25*	*28*	.....	.....	.....	
		F	23 05 —	.....	.....	.....	.....	
7	.....	e_E	2 49 27	11	.....	.....	.....	
		e_E	2 51 58	7	.....	.....	.....	
		L_E	2 54 33	24	.....	.....	.....	
		F_E	3 05 —	.....	.....	.....	.....	
18	.....	eP_E	10 43 40	*3*	.....	.....	.....	*Phases overlapping*
		F_E	10 54 —	.....	.....	.....	.....	N–S not recording.
20	.....	e_N	4 39 17	5	.....	.....	.....	
		L_E	4 40 13	17	.....	.....	.....	
		F_E	5 04 —	.....	.....	.....	.....	

New York. *New York. Fordham University.* D. H. Sullivan, S. J.

Lat., 40° 51′ 47″ N.; long., 73° 53′ 08″ W. Elevation, 23.9 meters.

Instrument: Wiechert, 80 kg.

		V	T_0	ϵ
Instrumental constants..	E	*72*	*5.0*	*0*
	N	72	5.0	0

(Report for May, 1919, 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, 25 kg.

	V	T_0
Instrumental constants..	10	20

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*km.*	
1919. May 6	.....	L_N	8 35 30	.....	.....	.....	.....	
		L_E	8 40 30	.....	.....	.....	.....	
		M_N	8 50 00	.....	.....	*600	.....	
		M_E	8 56 00	.....	*900	.....	.....	
		F	9 28 00	.....	.....	.....	.....	

* Trace amplitude.

TABLE 2.—*Instrumental seismological reports, May, 1919*—Continued.

Porto Rico. *Vieques. Magnetic Observatory.* U. S. Coast and Geodetic Survey. W. M. Hill.

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

Instruments: Two Bosch-Omori.

Instrumental constants..{E V 10, N V 10, T_0 17, 19

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s*	*Sec.*	μ	μ	*km.*	
May 2	.....	eL$_E$....	3 04 28	18	10	.....	.....	Nothing definite on N.
		F$_E$....	3 12 ..	18	.....	.....	.....	
3	.....	eE....	1 11 39	.....	.....	.....	.....	Probably PR$_1$.
		eN....	1 11 48	.....	.....	.....	.....	Do.
		eN....	1 21 27	.....	.....	.....	.....	
		eL$_E$...	1 43 40	.....	.....	.....	.....	
		eL$_N$...	1 54 30	.....	.....	.....	.....	
		M$_E$....	1 54 07	18	20	.....	.....	
		M$_N$....	2 00 58	19	.....	30	.....	
		F$_N$....	2 18 ..	.....	.....	.....	.....	
		F$_E$....	3 18 ..	16	.....	.....	.....	
6	.....	eP$_E$...	20 01 58	.....	.....	.....	.....	
		eP$_N$...	20 02 05	.....	.....	.....	.....	
		L$_E$....	20 40 15	40	.....	.....	.....	
		L$_N$....	20 40 46	40	.....	.....	.....	Well defined.
		M$_E$....	21 00 02	18	120	.....	.....	
		M$_N$....	21 00 20	19	.....	60	.....	
		C$_N$....	21 11 ..	19	.....	.....	.....	
		C$_E$....	21 21 ..	16	.....	.....	.....	
		F$_N$....	21 54 ..	19	.....	.....	.....	
		F$_E$....	22 05 ..	16	.....	.....	.....	
23	.....	eP$_E$...	3 18 10	13	10	.....	.....	Nothing on N.
		F$_E$...	3 44 ..	.....	.....	.....	.....	

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.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
May 2	.....	eL....	3 07 ..	16	.....	.....	.....	
		F.....	3 20 ..	.....	.....	.....	.....	
3	.....	P.....	1 04 57	.....	.....	.....	9,450	
		S.....	1 15 30	.....	.....	.....	.....	
		eL....	1 37 ..	.....	.....	.....	.....	
		L.....	1 54 ..	16	.....	.....	.....	
		F.....	2 45 ..	.....	.....	.....	.....	
6	.....	e?....	20 01 20	.....	.....	.....	9,700	
		S.....	20 12 05	.....	.....	.....	.....	
		L.....	20 35 00	40	.....	.....	.....	
		L.....	20 41 30	16	.....	.....	.....	
		L.....	20 56 00	20	.....	.....	.....	
		L.....	21 03 00	16	.....	.....	.....	
		F.....	22 05 ..	.....	.....	.....	.....	
18	.....	e.....	10 43 35	.....	.....	.....	.....	
		F.....	11 00 ..	.....	.....	.....	.....	
20	.....	e$_N$....	4 36 ..	.....	.....	.....	.....	
		F.....	4 55 ..	.....	.....	.....	.....	
22	.....	e.....	12 30 00	.....	.....	.....	.....	
		L.....	12 33 30	.....	.....	.....	.....	
		F.....	12 45 ..	.....	.....	.....	.....	

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 80k. vertical seismograph.

Instrumental constants..V 120, T_0 26

(Report for May, 1919, not received.)

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=0.45″.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
May 1	.....	eL....	6 09 00	.....	.....	.....	.....	Gradual thickening.
		M.....	6 15 54	.....	*800	.....	.....	
		F?....	6 50 18	.....	.....	.....	.....	
		i.....	2 33 54	.....	.....	.....	.....	
2	.....	L.....	2 54 42	.....	.....	.....	.....	
		eL....	3 02 42	.....	.....	.....	.....	
		M.....	3 08 42	.....	*2200	.....	.....	
		F.....	4 36 54	.....	.....	.....	.....	
3	.....	eP....	1 05 18	.....	.....	.....	9,520	Phases clearly marked.
		eS....	1 15 54	.....	.....	.....	.....	
		i.....	1 22 00	.....	.....	.....	.....	
		L.....	1 30 00	.....	.....	.....	.....	
		iL....	1 40 48	.....	.....	.....	.....	
		iL....	1 46 30	.....	.....	.....	.....	
		M.....	1 48 48	.....	*8800	.....	.....	
		F.....	2 16 42	.....	.....	.....	.....	
4	.....	L.....	23 41 24	.....	.....	.....	.....	
		eL....	23 43 00	.....	.....	.....	.....	
		M.....	23 44 30	.....	*200	.....	.....	
		F.....	23 54 12	.....	.....	.....	.....	
6	.....	L.....	5 05 18	.....	.....	.....	.....	
		eL....	5 07 18	.....	.....	.....	.....	
		M.....	5 10 54	.....	*300	.....	.....	
		F?....	6 01 00	.....	.....	.....	.....	
6	.....	e.....	20 00 00	.....	.....	.....	9,520	
		eP....	20 01 24	.....	.....	.....	.....	
		P.....	20 02 12	.....	.....	.....	.....	
		iP....	20 04 54	.....	.....	.....	.....	
		iP....	20 07 24	.....	.....	.....	.....	
		S.....	20 12 00	.....	.....	.....	.....	
		eS....	20 12 48	.....	.....	.....	.....	
		L.....	20 20 06	.....	.....	.....	.....	
		L.....	20 24 06	.....	.....	.....	.....	
		L.....	20 39 30	.....	.....	.....	.....	
		iL....	20 43 36	.....	.....	.....	.....	
		iL....	20 47 36	.....	.....	.....	.....	Well defined vibrations continue until 21^h 33^m.
		iL....	20 49 36	.....	.....	.....	.....	
		M.....	20 52 36	.....	*7800	.....	.....	
		M.....	21 02 54	.....	*8500	.....	.....	
		eL....	21 56 00	.....	.....	.....	.....	Increase of movement.
		M.....	22 00 30	.....	*3500	.....	.....	
7	.....	F?....	0 47 36	.....	.....	.....	.....	
7	.....	L.....	5 44 12	.....	*100	.....	.....	
		F.....	5 48 18	.....	.....	.....	.....	
7	.....	P.....	5 59 36	.....	.....	.....	.....	
		e.....	6 08 30	.....	.....	.....	.....	
		S?....	6 10 30	.....	.....	.....	.....	
		eS?...	6 12 54	.....	.....	.....	.....	
		e.....	6 16 36	.....	.....	.....	.....	
		eL....	6 23 00	.....	.....	.....	.....	
		M.....	6 31 00	.....	*1400	.....	.....	
		eL*rep.*	7 25 54	.....	.....	.....	.....	
		M.....	7 29 06	.....	*200	.....	.....	
		F.....	7 46 06	.....	.....	.....	.....	
7	.....	L.....	10 28 18	.....	.....	.....	.....	
		M.....	10 33 24	.....	*50	.....	.....	
8	.....	e?....	10 50 30	.....	.....	.....	.....	
		L.....	11 03 00	.....	.....	.....	.....	
		eL....	11 04 48	.....	.....	.....	.....	
		M.....	11 08 42	.....	*400	.....	.....	
8	.....	M.....	21 11 12	.....	*50	.....	.....	
14	.....	L.....	4 49 18	.....	*50	.....	.....	
		F.....	4 55 36	.....	.....	.....	.....	
18	.....	i.....	12 34 30	.....	.....	.....	.....	Probably off west coast of Vancouver Island.
		eL....	12 44 00	.....	.....	.....	.....	
		M.....	12 44 24	.....	*400	.....	.....	
		F.....	13 08 30	.....	.....	.....	.....	
19	.....	L?....	5 01 36	.....	*50	.....	.....	

*Trace amplitude.

TABLE 2.—*Instrumental seismological reports, May, 1919*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
Canada. *Toronto. Dominion Meteorological Service*—Continued.								
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
May 20	.....	e.....	4 29 12	.....	.....	.....	.....	
		L.....	4 38 42	.....	.....	.....	.....	
		eL.....	4 41 42	.....	.....	.....	.....	
		M.....	4 42 06	.....	*200	.....	.....	
		F.....	4 48 30	.....	.....	.....	.....	
22	.....	L.....	12 11 18	.....	.....	.....	.....	
		L.....	12 24 36	.....	.....	.....	.....	
		eL.....	12 29 06	.....	.....	.....	.....	
		M.....	12 35 24	.....	*800	.....	.....	
		F.....	13 14 12	.....	.....	.....	.....	
23	.....	L.....	7 08 36	.....	.....	.....	.....	
		M.....	7 12 00	.....	*200	.....	.....	Thickening.
		F.....	7 29 36	.....	.....	.....	.....	
27	.....	L.....	17 51 30	.....	.....	.....	.....	
		L.....	18 03 42	.....	.....	.....	.....	
		M.....	18 08 30	.....	*100	.....	.....	
		F.....	18 18 36	.....	.....	.....	.....	
29	.....	eL.....	6 29 06	.....	.....	.....	.....	Gradual thickening
		M.....	6 30 06	.....	*200	.....	.....	
		F.....	6 37 06	.....	.....	.....	.....	

* 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 $\frac{T_2}{T_1}$..18. Pillar deviation, 1 mm. swing of boom=0.54″.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
May 1	.....	L.....	6 25 53	.....	.....	.....	.....	
		M.....	6 30 18	.....	*100	.....	.....	
		F?.....	7 13 35	.....	.....	.....	.....	
1	.....	L.....	16 10 42	.....	.....	.....	.....	
		M.....	16 16 36	.....	*100	.....	.....	
1	.....	L.....	22 09 14	.....	.....	.....	.....	
		M.....	22 14 38	.....	*200	.....	.....	
		F.....	22 24 28	.....	.....	.....	.....	
2	.....	P.....	2 29 37	.....	.....	.....	.....	
		L.....	2 41 33	.....	.....	.....	.....	
		M.....	2 50 28	.....	*2,400	.....	.....	
		F.....	5 01 52	.....	.....	.....	.....	
2	.....	M.....	7 06 18	.....	*50	.....	.....	
3	.....	P.....	1 01 55	.....	.....	.....	7,530	
		S.....	1 10 51	.....	.....	.....	.....	
		L.....	1 24 44	.....	.....	.....	.....	
		M.....	*1 30 02*	.....	*3,500	.....	.....	
		F.....	4 11 51	.....	.....	.....	.....	
4	.....	L?.....	23 14 58	.....	.....	.....	.....	
		M.....	23 28 15	.....	*100	.....	.....	
		F.....	23 49 23	.....	.....	.....	.....	
6	.....	L?.....	4 49 26	.....	.....	.....	.....	
		M.....	4 54 21	.....	*300	.....	.....	
		F.....	5 06 10	.....	.....	.....	.....	
6	.....	P.....	19 50 51	.....	.....	.....	6,860	
		S.....	20 05 13	.....	.....	.....	.....	
		L.....	20 18 59	.....	.....	.....	.....	
		M.....	20 37 40	.....	*21,000	.....	.....	
7	.....	F.....	1 04 44	.....	.....	.....	.....	
7	.....	P.....	5 37 43	.....	.....	.....	4,690	
		S.....	5 43 08	.....	.....	.....	.....	
		L.....	5 52 58	.....	.....	.....	.....	
		M.....	6 02 49	.....	*1,000	.....	.....	
		$L_{resp.}$	7 40 51	.....	.....	.....	.....	
		M.....	7 44 09	.....	.....	.....	.....	
		M.....	7 49 27	.....	*200	.....	.....	
		F.....	*7 52 28*	.....	.....	.....	.....	
7	.....	M.....	10 07 15	.....	*200	.....	.....	Very gradual thickening.
8	.....	L.....	10 47 38	.....	.....	.....	.....	
		M.....	10 52 33	.....	*500	.....	.....	
		F.....	11 00 26	.....	.....	.....	.....	

* Trace amplitude.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
Canada. *Victoria, B. C. Dominion Meteorological Service*—Contd.								
1919.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
May 8	.....	M.....	21 06 53	.....	*200	.....	.....	
		F.....	21 13 46	.....	.....	.....	.....	
14	.....	M.....	4 35 06	.....	*100	.....	.....	
18	.....	P.....	10 28 47	.....	.....	.....	270	Probably off west coast of Vancouver Island.
		L.....	10 29 17	.....	.....	.....	.....	
		M.....	10 30 16	.....	*100	.....	.....	
		F.....	10 39 07	.....	.....	.....	.....	
			Vertical					
		P.....	*10 28 44*	*2*	.....	.....	*360*	
		L.....	*10 29 24*	*3*	.....	.....	.....	
		M.....	*10 30 24*	*5*	*7*	.....	.....	
		F.....	*10 34 08*	.....	.....	.....	.....	
19	.....	L.....	4 32 49	.....	.....	.....	.....	
		M.....	4 41 40	.....	*500	.....	.....	
		F.....	4 52 29	.....	.....	.....	.....	
19	.....	M.....	23 38 45	.....	*200	.....	.....	
20	.....	P.....	4 21 35	.....	.....	.....	550	
		L.....	4 22 34	.....	.....	.....	.....	
		M.....	4 23 33	.....	1,500	.....	.....	
		F.....	4 39 46	.....	.....	.....	.....	
			Vertical					
		L.....	*4 22 30*	*16*	.....	.....	.....	
		M.....	*4 23 34*	*14*	*6*	.....	.....	
22	.....	L.....	12 04 54	.....	.....	.....	.....	
		M.....	12 07 21	.....	*300	.....	.....	
		F.....	13 05 23	.....	.....	.....	.....	
23	.....	P.....	7 06 23	.....	.....	.....	.....	
		M.....	7 17 42	.....	*250	.....	.....	
		F.....	7 29 00	.....	.....	.....	.....	No further record until the 30th. supply of paper exhausted.

* Trace amplitude.

SEISMOLOGICAL DISPATCHES.[1]

Redding, Calif., May 2, 1919.

An earthquake of 15 seconds duration was felt here early to-day and also at Anderson, Calif. No damage was reported. (Assoc. Press.)

Laspalmas, Canary Islands, May 13, 1919.

Four people were killed in the earthquake which shook the island of Fuertaventura several days ago. The bulk of the population of the island has fled. Relief measures have been undertaken. (Assoc. Press.)

Flagstaff, Ariz., May 23, 1919.

A light earthquake shock at 5:05 o'clock this morning, following a night of rain, thunder, lightning, and snow roused the city from its slumbers but caused no material damage. The home of C. O. Lampland, astronomer at Lowell Observatory, was badly shaken. (Assoc. Press.)

Tokyo, Japan, May 24, 1919.

Sixteen thousand persons were killed or injured by a volcanic eruption in central Java on May 20. This information is contained in official advices from Batavia. (Assoc. Press.)

Vincennes, Ind., May 25, 1919.

Earthquake shocks lasting two minutes were felt here and at other places in southern Indiana and Illinois and western Kentucky to-day. Many persons were awakened by the tremors, but late to-night no reports of damage had been received. (Assoc. Press.)

Amsterdam, May 26, 1919.

The volcano of Kalut in Java has burst into eruption, wiping out 20 villages in the district of Brengat and 11 in the vicinity of Blitar, and causing deaths estimated at 15,000, according to a Central News dispatch received here. (Assoc. Press.)

[1] Reported by the organization indicated and collected by the seismological station, Georgetown University, Washington, D. C.

TABLE III.—*Data furnished by the Canadian Meteorological Service, June, 1919.*

Stations.	Altitude above mean sea level, Jan. 1, 1919.	Pressure.			Temperature of the air.						Precipitation.		
		Station reduced to mean of 24 hours.	Sea level reduced to mean of 24 hours.	Departure from normal.	Mean max.+ mean min.÷ 2.	Departure from normal.	Mean maximum.	Mean minimum.	Highest.	Lowest.	Total.	Departure from normal.	Total snowfall.
	Feet.	*Inches.*	*Inches.*	*Inches.*	*° F.*	*° F.*	*° F.*	*° F.*	*° F.*	*° F.*	*Inches.*	*Inches.*	*Inches.*
St. Johns, N. F.	125	29.91	30.05	+0.14	47.9	− 3.7	56.9	39.0	70	28	4.08	+0.48	.....
Sydney, C. B. I.	48	30.07	30.11	+0.16	55.2	− 0.2	66.7	43.6	84	34	2.66	−0.57	.....
Halifax, N. S.	88	30.00	30.11	+ .16	57.8	+ 0.1	67.8	47.8	87	34	2.68	−1.08	.....
Yarmouth, N. S.	65	30.03	30.10	+ .15	56.4	+ 1.4	65.1	47.7	78	37	1.75	−1.01	.....
Charlottetown, P. E. I.	38	30.05	30.09	+ .17	57.6	+ 0.2	66.8	48.4	81	36	2.31	−0.36	.....
Chatham, N. B.	28	30.07	30.10	+ .21	61.1	+ 1.1	73.4	48.9	92	38	1.87	−1.59	.....
Father Point, Que.	20	30.04	30.06	+ .19	54.4	+ 1.4	63.5	45.3	76	33	2.84	−0.14	.....
Quebec, Que.	296	29.79	30.11	+ .19	65.8	+ 4.6	76.8	54.8	92	40	2.81	−0.84	.....
Montreal, Que.	187	29.89	30.09	+ .15	69.7	+ 3.8	78.3	59.1	92	43	4.17	+0.64	.....
Stonecliffe, Ont.	489	29.48	30.08	+ .14	62.7	+ 1.1	84.5	40.9	98	26	5.08	+1.92	.....
Ottawa, Ont.	236	29.84	30.10	+ .16	70.9	+ 5.6	82.6	59.2	96	45	2.96	+0.04	.....
Kingston, Ont.	285	29.79	30.10	+ .13	70.0	+ 6.6	78.3	61.7	91	48	3.48	+1.05	.....
Toronto, Ont.	379	29.68	30.07	+ .10	72.4	+ 9.0	83.4	61.3	94	47	2.72	−0.08	.....
Cochrane, Ont.	930	.....	.....	.....	67.6	.....	81.8	53.4	92	31	0.48	.....	.....
White River, Ont.	1,244	28.79	30.07	+ .13	64.6	+ 5.9	79.4	49.9	91	26	1.09	−1.13	.....
Port Stanley, Ont.	592	29.45	30.08	+ .11	70.4	+ 6.6	80.8	60.0	90	44	1.87	−0.86	.....
Southampton, Ont.	656	29.39	.....	.....	69.2	+ 8.8	79.2	59.3	93	42	1.24	−1.11	.....
Parry Sound, Ont.	688	29.43	30.11	+ .15	72.0	+10.3	83.0	59.0	97	42	1.66	−0.76	.....
Port Arthur, Ont.	644	29.40	30.12	+ .18	62.0	+ 5.8	70.8	53.2	87	40	1.18	−1.55	.....
Winnipeg, Man.	760	29.17	29.99	+ .10	67.9	+ 5.7	79.6	56.2	89	35	4.95	+1.66	.....
Minnedosa, Man.	1,690	28.21	29.99	+ .10	64.4	+ 4.8	77.0	51.8	87	28	3.36	+0.38	.....
Le Pas, Man.	860	.....	.....	.....	65.0	.....	77.2	52.8	92	35	3.56	.....	.....
Qu'Appelle, Sask.	2,115	27.72	29.93	+ .06	65.7	+ 5.8	80.0	51.4	94	33	2.95	−0.47	.....
Medicine Hat, Alb.	2,144	27.60	29.81	− .04	69.2	+ 7.2	84.1	54.3	103	33	0.81	−1.95	.....
Moose Jaw, Sask.	1,759	.....	.....	.....	68.1	.....	84.3	51.9	101	25	3.24	.....	.....
Swift Current, Sask.	2,392	27.37	29.94	+ .07	66.5	+ 6.5	82.7	50.4	95	21	0.56	−2.11	.....
Calgary, Alb.	3,428	26.41	29.92	+ .08	59.6	+ 3.6	77.4	41.9	94	27	0.29	−2.16	.....
Banff, Alb.	4,521	25.39	29.90	+ .06	53.4	+ 1.9	68.9	38.0	89	26	1.02	−2.31	0.5
Edmonton, Alb.	2,150	27.00	29.85	+ .01	57.8	+ 0.9	72.2	43.5	89	30	0.87	−1.99	.....
Prince Albert, Sask.	1,450	28.37	29.92	+ .05	64.7	+ 7.0	78.7	50.7	93	30	2.10	−0.41	.....
Battleford, Sask.	1,592	28.17	29.88	+ .02	64.6	+ 5.1	79.0	49.3	97	24	1.32	−1.99	.....
Kamloops, B. C.	1,262	28.75	30.04	+0.17	51.6	− 2.2	74.8	48.4	96	39	0.67	−0.75	.....
Victoria, B. C.	230	29.83	30.09	+ .08	54.4	− 1.9	61.8	47.0	70	43	0.53	−0.67	.....
Barkerville, B. C.	4,180	25.72	30.02	+0.15	46.3	− 4.4	57.5	35.1	77	30	3.78	+0.30	11.2
Triangle Island, B. C.	680	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Prince Rupert, B. C.	170	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hamilton, Ber.	151	29.98	30.14	+ .02	73.1	− 1.9	78.4	67.8	83	63	2.82	−3.13	.....

SEISMOLOGY.

W. J. HUMPHREYS, Professor in Charge.

[Dated: Weather Bureau, Washington, D. C., Aug. 2, 1919.]

TABLE 1.—*Noninstrumental earthquake reports, June, 1919.*

Day.	Approximate time, Greenwich Civil.	Station.	Approximate latitude.	Approximate longitude.	Intensity Rossi-Forel.	Number of shocks.	Duration.	Sounds.	Remarks.	Observer.
	H. m.	CALIFORNIA.	° ′	° ′			*Sec.*			
June 21	6 55	Lone Pine	36 37	118 01	3	1	.....	None	.....	G. F. Marsh
21	19 58	Lone Pine	36 37	118 01	5	1	Several	Loud rumbling.	Furniture moved	G. F. Marsh.
24	21 12	San Diego	32 43	117 10	4	2	1	None	Buildings shaken	H. F. Alciatore.
24	23 24	Lone Pine	36 37	118 01	5	1	25	None	Felt by many	G. F. Marsh.

TABLE 2.—*Instrumental reports, June, 1919.*

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E.	Amplitude. A_N.	Distance.	Remarks.

Alabama. *Mobile. Spring Hill College.* Earthquake Station. Cyril Ruhlmann, S. J.

Lat., 30° 41′ 44″ N.; long., 88° 08′ 46″ W. Elevation, 60 meters.

Instrument: Wiechert 80 kg.; astatic, horizontal pendulum.

(No earthquake recorded during June, 1919.)

Alaska. *Sitka. Magnetic Observatory.* U. S. Coast and Geodetic Survey. F. P. Ulrich.

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

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

Instrumental constants..		V	T_0
	E	10	17.7
	N	10	16.6

(No earthquake recorded during June, 1919.)

Arizona. *Tucson. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Wm. H. Cullum.

Lat., 32° 14′ 48″ N.; long., 110° 50′ 06″ W. Elevation, 709.6 meters.

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

Instrumental constants..		V	T_0
	E	10	14
	N	10	18

1919.			H. m. s.	Sec.	μ	μ	Km.	Remarks.
June 29	.....	P_N	0 55 41	3	.....	.....	.....	Trace on E.-W.
		L_N	0 57 50	.....	.....	.....	.....	
		M_N	0 58 00	8	.....	20	.....	
		C_N	0 59 45	6	.....	.....	.....	
		F_N	1 02 ..	.....	.....	.....	.....	
29	.....	eP	23 26 00	.....	.....	.....	.....	No trace on E.-W.
		S_N	23 30 54	.....	.....	.....	.....	No distinct maximum amplitude about 0.1 mm.
		e_N	23 34 30	.....	.....	.....	.....	
		eL_N	23 39 ..	.....	.....	10	.....	
		F_N	23 52 ..	.....	.....	.....	.....	

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, 1,281.4 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.

1919.			H. m. s.	Sec.	μ	μ	Km.	Remarks.
June 13	.....	.....	.....	.....	*100	*100	.....	Tremor during 24 hours preceding 15h. 00m.
24	.....	.....	21 11 30	.....	*200	*300	.....	Light shock about 2 sec.
26	.....	.....	.....	.....	*200	*300	.....	Tremors during 24 hours preceding 15h. 00m. on date given.
30	.....	.....	.....	.....	*100	*100	.....	

*Amplitude on instrument.

Date.	Character.	Phase.	Time.	Period. T	Amplitude. A_E.	Amplitude. A_N.	Distance.	Remarks.

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

Lat., 37° 20′ 36″ N.; long., 124° 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.

Instrumental constants .....

1919.			H. m. s.	Sec.	μ	μ	Km.	Remarks.
June 10	.....	L_N	7 00 00	.....	.....	.....	.....	Active on both components.
		F_N	11 30 00	.....	.....	.....	.....	Weaker on E.-W.
14	.....	.....	.....	.....	.....	.....	.....	Visible activity on N.-W. at intervals during the day.
19	.....	L_N	2 30 00	.....	.....	.....	.....	Visible waves.
		F_N	4 45 00	.....	.....	.....	.....	

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	T_0
	110	6.4

1919.			H. m. s.	Sec.	μ	μ	km.	Remarks.
June 15	.....	eE	10 23 ..	.....	.....	.....	.....	Very feeble quake.
		F	10 30 ..	.....	.....	.....	.....	
29	.....	P	23 20 06	.....	.....	.....	3,000	
		S	23 24 48	.....	.....	.....	.....	
		L	23 27 26	.....	.....	.....	.....	
		L	23 29 30	24	.....	.....	.....	
30	.....	F	0 10 ..	.....	.....	.....	.....	

District of Columbia. *Washington. Georgetown University.* F. A. 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	0
	N	143	5.2	0
	Z	80	3.0	0

1919.			H. m. s.	Sec.	μ	μ	km.	Remarks.
June 29	.....	e	15 17 29	.....	.....	.....	.....	Heavy microseisms.
		iE?	15 21 46	.....	.....	.....	.....	Doubtful seismic origin.
		iN	15 21 48	.....	.....	.....	.....	
		F	16 ca	.....	.....	.....	.....	
29	.....	e	23 20 08	.....	.....	.....	.....	Heavy microseisms.
		iS	23 24 48	.....	.....	.....	.....	
		eL?	23 26 30	11	.....	.....	.....	On Bosch photographic machine, 23h 27m 36s.
		ME1	23 27 07	11	*1,700	.....	.....	
		ME2	23 30 41	16	*1,400	.....	.....	
		F?	1 +	.....	.....	.....	.....	Very doubtful.
			Vertical.			*Az.*		
29	.....	eP	23 20 08	.....	.....	.....	.....	Heavy microseisms.
		eS	23 24 48	.....	.....	.....	.....	
		eL	23 26 24	11	.....	.....	.....	
		M	23 27 15	16	*300	.....	.....	
		F	1 +	.....	.....	.....	.....	

* Trace amplitude.

TABLE 2.—*Instrumental reports, June, 1919*—Continued.

Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Frank Neumann.

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.

T_0
Instrumental constant..18.4. Sensitiveness 0.40 arc tilt=1 mm.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E.	Amplitude. A_N.	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*km.*	
June 1	.....	L.....	7 10 30	.....	.....	.....	.....	
		M.....	7 11 48	15	*300	.....	.....	
		C.....	7 16 ..	19	.....	.....	.....	
		F.....	7 41 ..	18	.....	.....	.....	
10	.....	eP.....	20 30 36	.....	.....	.....	.....	
		L.....	20 37 ..	.....	.....	.....	.....	
		M.....	20 44 00	19	*300	.....	.....	
		C.....	20 50 ..	20	.....	.....	.....	
		F.....	20 59 ..	.....	.....	.....	.....	
15	.....	L.....	19 43 ..	.....	.....	.....	.....	
		M.....	19 45 18	18	*100	.....	.....	
		F.....	19 48 ..	.....	.....	.....	.....	
24	.....	L.....	19 16 ..	.....	.....	.....	.....	
		M.....	19 26 ..	18	*100	.....	.....	
		F.....	19 35 ..	.....	.....	.....	.....	
26	.....	L.....	2 10 30	.....	.....	.....	.....	
		M.....	2 11 54	.....	*100	.....	.....	
		F.....	2 13 ..	.....	.....	.....	.....	
28	.....	eP.....	5 13 ..	.....	.....	.....	.....	Paper slipping.
		L.....	5 25 48	.....	.....	.....	.....	
		M.....	5 29 06	18	*200	.....	.....	
		C.....	5 33 ..	.....	.....	.....	.....	
		F.....	5 54 ..	.....	.....	.....	.....	
29	.....	P.....	23 25 18	18	.....	.....	.....	
		eS.....	23 34 42	.....	.....	.....	.....	
		eL.....	23 45 21	.....	.....	.....	.....	
		M.....	23 49 18	17	*600	.....	.....	
		M.....	23 51 54	.....	.....	.....	.....	
		C.....	24 02 ..	20	.....	.....	.....	
		F.....	25 12 ..	19	.....	.....	.....	
30	.....	eP.....	8 43 ..	.....	.....	.....	.....	Difficult to identify because of tremors.
		eL.....	9 08 30	.....	.....	.....	.....	
		M.....	9 15 00	20	*200	.....	.....	
		C.....	9 19 18	20	.....	.....	.....	
		F.....	9 51 ..	18	.....	.....	.....	

* Trace amplitude.

Illinois. *Chicago. University of Chicago.* U. S. Weather Bureau.

Lat., 41° 47′ N., long., 87° 37′ W. Elevation, 180.1 meters.

Instruments: Two Milne-Shaw horizontal pendulums, 0.45 kg.

	V	T_0	ϵ	Sensitivity.
Instrumental constants..E	150	12	20:1	1″ arc tilt=26.6 mm.
Instrumental constants..N	150	8	20:1	1″ arc tilt=13.2 mm.

1919.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E.	Amplitude. A_N.	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*km.*	
June 1	.....	iP.....	7 15 45	.....	.....	.....	.....	Record difficult to read.
		S?.....	7 24 37	.....	.....	.....	.....	
		L?.....	7 34 ..	.....	.....	.....	.....	
		F.....	8 15 ..	.....	.....	.....	.....	
4	.....	eE.....	9 46 ..	.....	.....	.....	.....	Not discernible on N.–S.
		eL.....	9 51 30	.....	.....	.....	.....	
		L.....	9 57 ..	19	.....	.....	.....	
		F.....	10 30 ..	.....	.....	.....	.....	
9	.....	eL.....	7 55 ..	.....	.....	.....	.....	May not be seismic.
		F.....	8 20 ..	.....	.....	.....	.....	
12	.....	eL.....	11 49 ..	.....	.....	.....	.....	Time correction uncertain.
		L.....	11 52 ..	18	.....	.....	.....	
		F.....	12 13 ..	.....	.....	.....	.....	
15	.....	e.....	10 16 30	.....	.....	.....	.....	Very feeble. Time correction uncertain.
		L.....	10 31 ..	.....	.....	.....	.....	
		F.....	10 45 ..	.....	.....	.....	.....	
29	.....	P.....	0 51 00	.....	.....	.....	3,000	
		S.....	0 55 43	.....	.....	.....	.....	
		L.....	1 01 38	.....	.....	.....	.....	
		F.....	1 30 ..	.....	.....	.....	.....	
29	.....	P.....	15 26 04	.....	.....	.....	2,020	
		S.....	15 30 41	.....	.....	.....	.....	
		L.....	15 38 20	24	.....	.....	.....	
		L.....	15 46 00	.....	.....	.....	.....	
		F.....	16 15 ..	.....	.....	.....	.....	
29	.....	P.....	23 20 15	.....	.....	.....	2,980	
		S.....	23 24 55	.....	.....	.....	.....	
		L?.....	23 27 20	.....	.....	.....	.....	
		L.....	23 30 00	30	.....	.....	.....	
		L.....	23 40 00	16	.....	.....	.....	
30	.....	F.....	1 30 ..	.....	.....	.....	.....	
30	.....	P.....	7 50 43	.....	.....	.....	2,890	
		S.....	7 55 18	.....	.....	.....	.....	
		eL.....	7 59 10	.....	.....	.....	.....	
		L.....	8 23 00	22	.....	.....	.....	
		L.....	8 32 00	16	.....	.....	.....	
		F.....	10 20 ..	.....	.....	.....	.....	

TABLE 2.—*Instrumental reports, June, 1919*—Continued.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E.	Amplitude. A_N.	Distance.	Remarks.

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.

		V	T_0	ε
Instrumental constants..	E	177	3.4	4:1
	N	205	3.4	4:1

(Report for June, 1919, not received.)

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.

		V	T_0
Instrumental constants..	E	10	15
	N	10	15

1919			H. m. s.	Sec.	μ	μ	km.	
June 29	.....	P.....	23 20 14	3	.....	.....	2,970	
		IS_N...	23 24 55	14	.....	.....	.....	
		S_E....	23 24 54	12	.....	.....	.....	
		eL_N...	23 29 20	22	.....	.....	.....	
		eL_E...	23 31 20	.....	.....	.....	.....	L difficult to determine.
		M_E....	23 30 47	14	280	.....	.....	
		M_N....	23 33 46	15	.....	260	.....	
		C_N....	23 35 ..	13	.....	.....	.....	
		C_N....	23 44 ..	10	.....	.....	.....	
30	.....	F_N....	0 17 ..	10	.....	.....	.....	
		F_E....	0 18 ..	10	.....	.....	.....	

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.

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

		V	T_0	ε
Instrumental constants..	E	80	23	0
	N	50	25	4:1

(Report for June, 1919, not received.)

Missouri. *Saint 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.

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

(Report for June, 1919, not received.)

New York. Ithaca. Cornell University. Heinrich Ries.

Lat., 42° 26′ 58″ N.; long., 76° 29′ 09″ W. Elevation, 242.6 meters.

Instruments: Two Bosch-Omori, 25 kg., horizontal pendulums (mechanical registration.

		V	T_0	ε
Instrumental constants..	E	13	22	4:1
	N	14	25	4:1

(Report for June, 1919, not received.)

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E.	Amplitude. A_N.	Distance.	Remarks.

New York. *New York. Fordham University.* D. H. Sullivan, S. J.

Lat., 40° 51′ 47″ N.; long.. 73° 53′ 08″ W. Elevation, 23.9 meters.

Instrument: Wiechert, 80 kg.

		V	T_0	ε
Instrumental constants..	E	72	5.0	0
	N	72	5.0	0

(Report for June, 1919, 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, 25 kg.

	V	T_0
Instrumental constants..	10	20

1919			H. m. s.	Sec.	μ	μ	Km.
June 29	.....	P_E....	23 17 14	.....	.....	.....	970
		P_N....	23 17 20	.....	.....	.....	.....
		S_N....	23 18 56	.....	.....	.....	.....
		S_E....	23 19 ..	.....	.....	.....	.....
		L_E....	23 20 12	.....	.....	.....	.....
		L_N....	23 20 20	.....	.....	.....	.....
		M_N....	.....	.....	.....	*3,600	.....
		M_E....	23 21 56	.....	.....	*5,500	.....
		F_E....	23 25 16	.....	.....	.....	.....
		F_N....	23 45 ..	.....	.....	.....	.....

*Trace amplitude.

Porto Rico. *Vieques. Magnetic Observatory.* U. S. Coast and Geodetic Survey. W. M. Hill.

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

Instruments: Two Bosch-Omori.

		V	T_0
Instrumental constants..	E	10	17
	N	10	19

1919			H. m. s.	Sec.	μ	μ	Km.	
June 28	.....	P_E....	1 45 39	2	.....	.....	.....	Local; felt at Humacao, P. R.
		P_E....	1 45 40	2	.....	.....	.....	
		M_E....	1 46 10	.....	80	.....	.....	
		M_N....	1 46 14	.....	.....	120	.....	
		F.....	1 51 ..	3	.....	.....	.....	
29	.....	eP_E...	23 19 12	4	.....	.....	.....	
		eP_N...	23 19 27	.....	.....	.....	.....	
		PR_E...	23 19 35	.....	.....	.....	.....	
		PR_N...	23 19 52	.....	.....	.....	.....	
		S_E....	23 23 11	12	.....	.....	.....	
		S_N....	23 23 43	.....	.....	.....	.....	
		eL_E...	23 25 26	.....	.....	.....	.....	
		eL_N...	23 27 07	.....	.....	.....	.....	
		M_E....	23 29 40	17	160	.....	.....	
		M_N....	23 30 01	19	.....	320	.....	
		C_N....	23 31 ..	14	.....	.....	.....	
		C_E....	23 34 ..	18	.....	.....	.....	
		F_N....	23 44 ..	13	.....	.....	.....	
		F_E....	23 50 ..	13	.....	.....	.....	

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.

		V	T_0
Instrumental constants..	E	10	15
	N	10	16

1919			H. m. s.	Sec.	μ	μ	Km.
June 29	.....	P.....	23 21 00	.....	.....	.....	3,540
		S.....	23 26 20	.....	.....	.....	.....
		L.....	23 29 16	.....	.....	.....	.....
		L.....	23 34 ..	20	.....	.....	.....
		F.....	24 00 ..	.....	.....	.....	.....

TABLE 2.—*Instrumental reports, June, 1919*—Continued.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E.	Amplitude. A_N.	Distance.	Remarks.
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 80k. vertical seismograph.								
Instrumental constants..120				V 26	T_0			
1919 June 29	.....	i.....	*H. m. s.* 0 57 54	*Sec.*	μ	μ	*Km.*	Very small amplitudes.
		e.....	1 07 18	.....	.....	.....	.....	Small microseisms prevent the reading of P.
			1 20 ..	7.5	.....	.....	.....	
		F.....	1 40 ..	.....	.....	.....	.....	
29	.....	*O*.....	*15 06 03*	.....	.....	.....	6,600	Italian quake reported in press.
		P_N.....	15 16 10	.....	.....	.....	.....	
		ePB_{HN}	15 18 40	.....	.....	.....	.....	
		eS_N...	15 24 18	.....	.....	.....	.....	
		eL.....	15 34 30	22	.....	.....	.....	
		F.....	15 50 ..	.....	.....	.....	.....	
29	.....	*O*.....	*23 14 14*	.....	.....	.....	3,590	Very sharp offsets mark P. and S. eL is difficult to determine.
		iP.....	23 21 01	.....	.....	.....	.....	
		iS.....	23 26 24	.....	.....	.....	.....	
		L.....	23 31 30	.....	.....	.....	.....	Amplitudes small.
		L.....	23 35 ..	20	.....	.....	.....	
		L.....	23 46 ..	12	.....	.....	.....	
30	.....	L.....	0 15 ..	12	.....	.....	.....	
		F.....	0 35 ..	.....	.....	.....	.....	
30	.....	eN?...	7 48 30	.....	.....	.....	.....	Very small amplitudes.
		e.....	7 51 18	.....	.....	.....	.....	L waves regular and sinusoidal throughout.
		eL....	8 15 ..	20	.....	.....	.....	
			9 00 ..	15	.....	.....	.....	
		F.....	9 05 ..	.....	.....	.....	.....	
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..18.				T_0 Pillar deviation, 1 mm. swing of boom=0.45″.				
June 2	.....	L.....	6 59 18	.....	.....	.....	.....	Doubtful as to being seismic.
		M.....	6 59 48	.....	*200	.....	.....	
		F.....	7 03 06	.....	.....	.....	.....	
10	.....	L.....	20 57 54	.....	.....	.....	.....	
		M.....	20 58 36	.....	*100	.....	.....	
		F.....	21 03 48	.....	.....	.....	.....	
15	.....	M?....	16 17 54	.....	*100	.....	.....	Small micros going on.
15	.....	M.....	18 05 36	.....	*100	.....	.....	Do.
29	.....	L.....	1 03 18	.....	.....	.....	.....	
		L.....	1h12.00	.....	*100	.....	.....	Small micros of uniform character and intervals going on from 0h 30m 30s to 1h 30m 42s.
29	.....	L.....	15 39 48	.....	.....	.....	.....	
		L.....	15 42 30	.....	.....	.....	.....	
		M.....	15 43 36	.....	*100	.....	.....	
		F.....	15 50 12	.....	.....	.....	.....	
29	.....	P?....	23 21 54	.....	.....	.....	2,830?	Marked disturbance.
		S.....	23 26 24	.....	.....	.....	.....	
		iS.....	23 29 42	.....	.....	.....	.....	
		i.....	23 30 24	.....	.....	.....	.....	
		L.....	23 32 12	.....	.....	.....	.....	
		M.....	23 33 24	.....	*2,100	.....	.....	
		iL.....	23 34 54	.....	.....	.....	.....	
30	.....	F.....	0 30 24	.....	.....	.....	.....	
30	.....	eL....	8 22 30	.....	.....	.....	.....	
		eL....	8 32 48	.....	.....	.....	.....	
		M.....	8 45 12	.....	*200	.....	.....	
		F.....	9 10 12	.....	.....	.....	.....	

* Trace amplitude.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E.	Amplitude. A_N.	Distance.	Remarks.
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..18.				T_0 Pillar deviation, 1 mm. swing of boom=0.54″.				
June 2	.....	P.....	7 13 13	.....	.....	.....	.....	May not be a quake.
		M.....	7 14 02	.....	*100	.....	.....	
10	.....	L?....	21 03 00	.....	.....	.....	.....	
		M.....	21 09 24	.....	*100	.....	.....	
		F.....	21 14 29	.....	.....	.....	.....	
11	.....	M?....	6 55 09	.....	*50	.....	.....	May not be a quake.
14	.....	M.....	8 01 32	.....	*100	.....	.....	
15	.....	L?....	16 25 24	.....	.....	.....	.....	
		M.....	16 27 23	.....	*200	.....	.....	
		F.....	16 30 51	.....	.....	.....	.....	
15	.....	P?....	17 44 14	.....	.....	.....	.....	
		M.....	17 46 13	.....	*300	.....	.....	
		F.....	17 50 11	.....	.....	.....	.....	
29	.....	P or L.	1 06 00	.....	.....	.....	.....	
		M.....	1 06 59	.....	*500	.....	.....	
		F.....	1 12 53	.....	.....	.....	.....	
29	.....	M.....	15 51 48	.....	*200	.....	.....	
29	.....	P?....	23 22 19	.....	.....	.....	.....	
		S?....	23 28 42	.....	.....	.....	.....	
		L.....	23 38 03	.....	.....	.....	.....	
		M.....	23 48 12	.....	*1,800	.....	.....	
30	.....	F.....	00 46 14	.....	.....	.....	.....	
30	.....	M.....	8 44 00	.....	*200	.....	.....	
		F.....	9 19 44	.....	.....	.....	.....	

* Trace amplitude.

SEISMOLOGICAL DISPATCHES.[1]

Seattle, Wash., June 5, 1919.

What seemingly was an earth disturbance gave buildings in Seattle a slight shaking up to-night. The disturbance was felt as far as 45 miles from here. (Associated Press.)

Florence, Italy, June 29, 1919.

A violent earthquake shock was felt here this afternoon at 5:30 o'clock and reports state that neighboring towns were also shaken. So far as known only slight damage was done. (Associated Press.)

Florence, Italy, June 29, 1919.

Additional advice shows that damage was done by the earthquake of to-day. The tremor was sharp, people rushing from houses in panic. The damage in this city was slight.

Rome, Italy, June 30, 1919.

One hundred and twenty persons are estimated to have been killed in and near Vicchio, the center of the earth movements Sunday, in the Florence district, according to the Tempo. The town of Vicchio was reduced to a heap of ruins and a number of the villages were destroyed. (Associated Press.)

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

TABLE 3.—*Late reports (instrumental).*

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.

	V	T_0
Instrumental constants..	120	26

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E.	Amplitude. A_N.	Distance.	Remarks.
1919 Apr. 27	.....	e?$_N$	*H. m. s.* 0 52 07	*Sec.*	μ	μ	*km.*	Amplitudes very small. Preliminary waves very irregular.
		eL?	1 26 ..	28	.....	.....	.....	
		L	1 32 ..	24	.....	.....	.....	
		L	1 45 ..	15	.....	.....	.....	
		F	2 ca ..	.....	.....	.....	.....	
28	.....	e$_N$	6 33 52	.....	.....	.....	.....	
		e$_E$	6 38 08	.....	.....	.....	.....	
		eL$_E$	7 02 ..	20	.....	.....	.....	
		L	7 12 ..	12	.....	.....	.....	
		L	7 30 ..	12	.....	.....	.....	
		L	7 40 ..	12	.....	.....	.....	
		F	8	.....	.....	.....	.....	
30	.....	*O*	*7 16 30*	.....	.....	.....	(1)	
		eP	7 31 30	.....	.....	.....	.....	All phases difficult to read with precision, but all are readily determined as to character.
		ePR$_1$	7 36 18	.....	.....	.....	.....	
		eS?	7 44 12	.....	.....	.....	.....	
		eL	8 01 ..	55	.....	.....	.....	
		L	8 20 ..	25	.....	.....	.....	
		L	8 35 ..	18	.....	.....	.....	
		L	8 50 ..	15	.....	.....	.....	
		L	9 10 ..	14	.....	.....	.....	
		LR$_1$	9 20 ..	18	.....	.....	.....	
		L	9 35 ..	20	.....	.....	.....	
		L	10 00 ..	16	.....	.....	.....	
		L	10 20 ..	18	.....	.....	.....	
		L	10 35 ..	16	.....	.....	.....	
		L	11 05 ..	16	.....	.....	.....	
		L	11 30 ..	16	.....	.....	.....	
		L	12 00 ..	16	.....	.....	.....	
		F	12 30 ..	.....	.....	.....	.....	
May 1	.....	eL$_N$	5 59 ..	25	.....	.....	.....	
		L	6 10 ..	20	.....	.....	.....	
		L	6 22 ..	15	.....	.....	.....	
		F	6 40 ..	.....	.....	.....	.....	
2	.....	e	2 32 ..	.....	.....	.....	.....	
		e	2 34 ..	.....	.....	.....	.....	
		eL?$_E$	2 43 48	.....	.....	.....	.....	
		L$_N$	2 52 ..	25	.....	.....	.....	
		L$_N$	2 57 ..	21	.....	.....	.....	
		L	3 05 ..	21	.....	.....	.....	
		L	3 12 ..	17	.....	.....	.....	
		L	3 24 ..	16	.....	.....	.....	
		L	3 40 ..	16	.....	.....	.....	
		L	3 51 ..	16	.....	.....	.....	
		L	4 20 ..	15	.....	.....	.....	
		F	4 40 ..	.....	.....	.....	.....	
3	.....	e	6 15 24 6 22 ..	 7	.....	.....	.....	May not be seismic.
3	.....	*O*	*0 52 10*	.....	.....	.....	9,460	
		iP	1 04 46	.....	.....	.....	.....	
		iS	1 15 20	.....	.....	.....	.....	
		L?$_E$	1 30 30	.....	.....	.....	.....	
		L	1 34 ..	34	.....	.....	.....	
		L	1 45 ..	20	.....	.....	.....	
		L	2 00 ..	18	.....	.....	.....	
		L	2 10 ..	16	.....	.....	.....	
		L	2 25 ..	13	.....	.....	.....	
		L	2 40 ..	11	.....	.....	.....	
		L	3 00 ..	11	.....	.....	.....	
		L	3 19 ..	12	.....	.....	.....	
		L	3 40 ..	9	.....	.....	.....	
		L	4 08 ..	10	.....	.....	.....	
		F	4 15 ..	.....	.....	.....	.....	

[1] 12600 ca.

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

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E.	Amplitude. A_N.	Distance.	Remarks.
1919 May 6	.....	*O*	*H. m. s.* *19 48 19*	*Sec.*	μ	μ	*km.* 9,700	
		eP	20 01 06	.....	.....	.....	.....	
		S	20 11 51	.....	.....	.....	.....	
		L	20 31 ..	50	.....	.....	.....	
		L	20 45 ..	22	.....	.....	.....	
		L	20 55 ..	18	.....	.....	.....	
		L	21 05 ..	17	.....	.....	.....	
		L	21 15 ..	17	.....	.....	.....	
		L	21 30 ..	15	.....	.....	.....	
		L	21 44 ..	18	.....	.....	.....	
		L	22 05 ..	18	.....	.....	.....	
		L	22 30 ..	15	.....	.....	.....	
		L	22 50 ..	12	.....	.....	.....	
		F	23 05 ..	.....	.....	.....	.....	
7	.....	*O*	*5 21 58*	.....	.....	.....	9,020	
		eP	5 34 12	.....	.....	.....	.....	
		eS?	5 44 24	.....	.....	.....	.....	
		eSR1?	5 51 00	.....	.....	.....	.....	
		eL	6 04 ..	40	.....	.....	.....	
		L	6 22 ..	18	.....	.....	.....	
		L	6 30 ..	17	.....	.....	.....	
		L	6 50 ..	15	.....	.....	.....	
		F	7 15 ..	.....	.....	.....	.....	
8	.....	eL$_E$	11 05 .. 11 15 ..	 18	.....	.....	.....	N.–S. lost in microseisms.
8	.....	L	21 20 .. 21 32 ..	.....	.....	.....	.....	Rather irregular. May not be seismic.
20	.....	*O*	*4 19 54*	.....	.....	.....	3,980	
		P$_E$	4 27 11	.....	.....	.....	.....	
		S	4 32 57	.....	.....	.....	.....	
		L$_N$	4 37 30	.....	.....	.....	.....	
		L	4 40 ..	15	.....	.....	.....	
		L	4 46 ..	7	.....	.....	.....	
		F	5 05 ..	.....	.....	.....	.....	
22	.....	*O*	*11 52 48*	.....	.....	.....	6,760	
		P	12 03 02	.....	.....	.....	.....	
		S	12 11 19	.....	.....	.....	.....	
		eL	12 22 ..	.....	.....	.....	.....	
		L	12 28 ..	20	.....	.....	.....	
		L	12 30 ..	18	.....	.....	.....	
		L	12 42 ..	13	.....	.....	.....	
		L	12 50 ..	12	.....	.....	.....	
		F	.....	.....	.....	.....	.....	Lost in changing the sheets at 13h 15m.
23	.....	i	3 16 03	.....	.....	.....	.....	
		i	3 24 42	.....	.....	.....	.....	
		eL$_E$	3 32 ..	22	.....	.....	.....	Very irregular periods on N.–S. Amplitudes very small throughout.
		L	3 45 ..	22	.....	.....	.....	
		F	4 05 ..	.....	.....	.....	.....	
29	.....	eL	11 55 .. 12 20 ..	.....	.....	.....	.....	Very faint: barely discernible.

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.

	T_0
Instrumental constant..	18. Pillar deviation, 1 mm. swing of boom=0.50″.

Date.	Character.	Phase.	Time.	Period. T.	Amplitude. A_E.	Amplitude. A_N.	Distance.	Remarks.
1919. May 23	.....	L	*H. m. s.* 3 33 36	*Sec.*	μ	μ	*km.*	
		M	3 40 12	.....	*100	.....	.....	
		F	4 05 00	.....	.....	.....	.....	

*Trace amplitude.

SEISMOLOGY.

W. J. HUMPHREYS, Professor in Charge.

[Dated: Weather Bureau, Washington, D. C., Sept. 2, 1919.]

TABLE 1.—*Noninstrumental earthquake reports, July, 1919.*

Day.	Approximate time, Greenwich Civil.	Station.	Approximate latitude.	Approximate longitude.	Intensity Rossi-Forel.	Number of shocks.	Duration.	Sounds.	Remarks.	Observer.
		CALIFORNIA.								
	H. m.		° ′	° ′			*Sec.*			
July 13	12 13½	Corona	33 52	117 35	2	1	2 or 3	None	Felt by several	Thomas C. Sias.
20	4 15	Oak Grove	33 26	116 51	5	1	2	Loud	Felt by many	A. J. Berg.
31	21 30	Idria	36 24	120 42	3	2	1	None	Felt by several	O. M. Sherburne.
		KANSAS.								
26	12 55	Wichita	37 41	97 20	4	2	2	Loud rumbling	Felt by several	Mrs. J. B. Daze.

TABLE 2.—*Instrumental seismological reports, July, 1919.*

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

[For significance of symbols see REVIEW for January, 1919, p. 59.]

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

Alabama. *Mobile. Spring Hill College.* Earthquake Station. Cyril Ruhlmann, S. J.

Lat., 30° 41′ 44″ N.; long., 88° 08′ 46″ W. Elevation, 60 meters.

Instrument: Wiechert 80 kg.; astatic, horizontal pendulum.

(Report for July, 1919, not received.)

Alaska. *Sitka. Magnetic Observatory.* U. S. Coast and Geodetic Survey. F. P. Ulrich.

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

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

Instrumental constants..		*V*	T_0
	E	10	17.7
	N	10	16.6

(No earthquake recorded during July, 1919.)

Arizona. *Tucson. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Wm. H. Cullum.

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

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

Instrumental constants..		*V*	T_1
	E	10	15
	N	10	18

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

Arizona. *Tucson. Magnetic Observatory.* U. S. Coast and Geodeti Survey. Wm. H. Cullum.

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

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

Instrumental constants..		*V*	T_0
	E	10	14
	N	10	18

1919.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
July	1	P_N	21 55 16					
		eP_E	21 55 22					
		L_N	21 57 21					
		M_N	21 57 32	8		10		
		C_N	21 57 48					
		F_E	21 59 ..					
		F_N	22 00 ..					
	6	P_N	7 09 22					
		S_N	7 13 33					
		eL_N	7 16 38					
		P_E	7 20 33					
		C_N	7 21 ..					
		F_E	7 28 ..					
		F_N	7 32 ..					
	9	eP_N	19 23 14					eP_N faint.
		eS_E	19 27 14					
		S_N	19 27 20					
		eL_E	19 28 50					
		eL_N	19 29 51					
		M_N	19 30 14					
		C_N	19 33 55	5				
		F_E	19 35 ..					
		F_N	19 41 ..					

Period of pendulum: E. 17 sec., N. 20 sec.

TABLE 2.—*Instrumental seismological reports July, 1919*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
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.								
1919. July	3		*H. m. s.*	*Sec.*	*μ* 50	*μ* 50	*Km.*	
	15				100	100		
California. *Santa Clara. University of Santa Clara.* J. S. Ricard, S. J. Lat., 37° 26′ 36″ N.; long., 121° 57′ 63″ 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′ 35″ N.; long., 104° 56′ 54″ W. Elevation, 1,655 meters. Instrument: Wiechert 80 kg., astatic, horizontal pendulum. (*No earthquakes reported for July, 1919.*)								
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								
1919. July 6		P	*H. m. s.* 7 10 ca.	*Sec.*			*Km.* 3540?	Time correction uncertain.
		S	7 15 20ca					
		L	7 19 30ca	25				
		F	7 50					
8		P	21 25 15					
		S	21 34 48					
		L	21 56 ..	28				
		L	22 05 ..	20				
		L	22 10 ..	18				
		F	22 40 ..					
9		P?	19 26 16				3700?	
		S	19 31 45					
		L	19 38 10	12				
		F	20 30 ..					
10		e	2 42 40					
		F	2 52 ..					
11		P	0 36 57					
		S	0 44 00					
		eL	0 50 45					
		F	1 15 ..					
14		eL	14 26 20	16				
		F	14 45 ..					
17		P	16 25 57				3280	
		S	16 31 00					
		L	16 35 50	20				
		L	16 40 ..	14				
		F	16 50 ..					
18		e?	13 43 50					
		L	13 58 00					
		F	14 10 ..					
22		iP	22 07 10				2920	
		iS	22 11 47					
		L?	22 14 20					
		F	22 30 ..					
24		e	2 27 56					
		F	2 32 ..					
25		e	19 05 00					
		N?	19 09 14					
		F	19 30 ..					
31		eI'	22 02 42				8220	
		S	22 12 13					
		F	22 30 ..					

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
District of Columbia. *Washington. Georgetown University.* F. A. Tondori, 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.. E: *V* 165, *T*$_0$ 5.4, ε 0; N: 143, 5.2, 0; Z: *80*, *5.0*, *0*								
1919. July 1		e$_E$	*H. m. s.* 21 36 27	*Sec.*	*μ*	*μ*	*km.*	
		eL$_E$	21 49 30					
		eL$_N$	21 49 36					
		F	22 46 ..					
6		eP$_N$	7 10 05					
		eP$_E$	7 10 15					
		S	7 15 35					
		eL	7 18 30	10				
		F	7 50 ..					
			Vertical.					
		eP	*7 10 04*					
		S	*7 15 55*					
		F	*8 00* ..					
7		e$_E$	14 48 ..					N-S does not show, microseisms.
		F	15 20 ..					
8		e	21 25 52					Heavymicroseisms
		eS$_N$?	21 34 42					
		eL$_E$	21 47 ..	11				
		eL$_N$	21 47 06	11				
		F	23 25 ..					
9		e	19 26 ..					Do.
		eS$_N$?	19 31 40					
		eL$_E$	19 38 ..	11				
		eL$_N$	19 38 ..	15				
		L$_N$	19 42 ..	11				
		L$_E$	19 43 ..	9				
		F$_E$	20 15 ..					
10		e$_N$	2 41 26					Microseisms.
		e$_E$	2 41 30					
		L$_N$	2 44 19	10				
		F	3 (ca.)					
11		e	0 37 ..					Do.
		S$_E$?	0 42 12					
		S$_N$?	0 42 13					
		eL	0 44 30	8				
		F	1 30 ..					
14		e$_E$?	14 16 17					
		e$_N$?	14 16 28					
		eL	14 26 36	12				
		F	14 48 ..					
17		iP	16 25 58					
		eS	16 31 04					
		eL	16 36 00	16				
		L$_E$	16 41 ..	14				
		L$_N$	16 41 ..	11				
		F	16 55 ..					
22		iP$_N$	22 07 12					
		iP$_E$	22 07 13					
		S	22 11 48					
		eL	22 13 48	6				
		F	22 55 ..					
		iP	*22 07 11*					
		S	*22 11 53*					
		eL	*22 13 30*					
		F	*22 55* ..	6				
25		e$_E$	17 13 ..					Does not show on N-S component.
		F	17 21 ..					
31		e$_E$?	22 05 43					Heavymicroseisms.
		S$_E$?	22 12 16					Does not show on N-S component.
		F	22 27 ..					
Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Frank Neumann. 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 18.1. Sensitiveness 0.40 arc tilt=1 mm. (Report for July not received.)								

TABLE 2.—*Instrumental seismological reports, 1919*—Continued.

Illinois. *Chicago*. *University of Chicago*. U. S. Weather Bureau.

Lat., 41° 47′ N.; long., 87° 37′ W. Elevation, 180.1 meters.

Instruments: Two Milne-Shaw horizontal pendulums, 0.45 kg.

Instrumental constants		V	T_0	ε	Sensitivity.
	E	150	12	20:1	1″ arc tilt=26.6 mm.
	N	150	8	20:1	1″ arc tilt=13.2 mm.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
July 1		e	17 21 30					
		L	17 29 15	15				
		F	17 50 ca					
1		P	21 36 26				2,990	
		S	21 41 08					
		L?	21 43 50					
		F	22 30 ..					
2		e	8 08 18					
		eL	8 14 ..					
		L	8 16 ..	15				
		F	8 45 ..					
4		e	8 39 07					
		L	8 46 ..	18				
		F	9 10 ..					
6		P	7 09 55				3,300	
		iS	7 15 ..					
		L	7 18 10	26				
		F	8 40 ..					
7		eL	14 47 ..					May not be seismic.
		L	14 50 ..	24				
		L	14 56 ..	18				
		F	15 30 ..					
8		P	21 26 00				8,800	
		S	21 36 ..					
		eL	21 51 ..					
		L	22 03 ..	26				
		M_E	22 12 ..		*600			
		L	22 14 ..	20				
		L	22 22 ..	15				
9		F	0 30 ..					
9		P	19 25 38				3,200	
		iS	19 30 30					
		L	19 33 15	10				
		M_N	19 37 30			*2,500		
		F	20 40 ..					
10		e	2 37 28					
		F	3 15 ..					
11		iP	0 37 50				3,875	
		iS	0 43 30					
		SR_1	0 46 15					
		L	0 48 08	24				
		L	0 54 ..	20				
		M	0 55 ..		*200			
		F	1 50 ..					
11		P	4 16 43					
		S	4 22 30					
		SR_1	4 25 15					
		L	4 30 30	15				
		F	4 55 ..					
12		P?	22 35 45					
		S?	22 41 38					
		L	22 47 30	15				
		F	23 20 ..					
14		L	14 25 ..	15				Beginning not recorded. Adjusting instrument.
		F	15 40 ..					
16		e	18 51 ..					
		L	18 58 ..	15				
		F	19 50 ..					
17		eL	10 48 ..					
		F	11 20 ..					
17		P	16 26 05				3,300	
		S	16 31 10					
		L	16 38 ..	16				
		F	17 30 ..					
18		eL	2 53 ..	16				
		F	3 05 ..					
18		P	13 42 44				3,630	
		S	13 48 10					
		L	13 53 10					
		F	14 45 ..					
20		P?	8 30 20					
		S?	8 35 13					
		L	8 38 15	16				
		F	8 55 ..					

* Trace amplitude.

Illinois. *Chicago*. *University of Chicago*.—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
22		iP	22 07 14				2,930	
		PR_1	22 08 44					
		iS	22 11 52					
		L	22 14 30	15				
		F	23 20 ..					
24		P	2 27 41				5,870?	
		S?	2 35 10					
		L?	2 46 40	25				
		L	2 59 ..	16				
		F	4 10 ..					
24		P?	4 52 18					
		S?	4 58 04					
		L?	5 02 20					
		F	5 50 ..					
25		P	19 03 10				3,840	
		S	19 08 48					
		L?	19 14 45					
		F	20 00 ..					
31		P?	7 29 15					
		S?	7 35 40					
		L	7 48 ..	18				
		L	7 57 56	22				
		L	8 10 ..	15				
		F	9 30 ..					
31		P	22 01 11				5,770	
		S	22 08 35					
		eL?	22 18 ..					
		F	22 40 ..					

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		V	T_0	ε
	E	177	3.4	4:1
	N	205	3.4	4:1

(Report for July, 1919, not received.)

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		V	To
	E	10	15
	N	10	15

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919			*H. m. s.*	*Sec.*	μ	μ	*km.*	
July 6		eP_E	7 10 15					First appearance of long waves rather abrupt.
		eP_N	7 10 30					
		S_N	7 15 00					
		S_E	7 15 17					
		L_E	7 20 49					
		L_N	7 20 56					
		M_E	7 21 20	10	40			
		M_N	7 22 30	9		50		
		C_N	7 24 ..					
		C_E	7 26 ..					
		F_N	7 35 ..					
		F_E	7 37 ..					
8		eL_N	21 59 00					L_N is faint until 22:07.
		eL_E	22 01 50	24				
		L_N	22 07 00					
		M_E	22 07 04	20	50			
		M_N	22 10 40	17				
		M_N	22 15 50	17				
		C_E	22 15 ..	18				
		F_N	22 21 ..					
		F_E	22 26 ..	18				
9		eP_N	19 31 41					E-W not in operation.
		L_N	19 38 17	14				
		M_N	19 39 00	12		80		
		C_N	19 39 55	9				
		F_N	19 58 ..	8				

TABLE 2.—*Instrumental seismological reports, 1919*—Continued.

Maryland. *Cheltenham. Magnettic Observatory*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919			*H. m. s.*	*Sec.*	μ	μ	*km.*	
July 17	.....	eP_E	16 30 42	.....	.....	.....	.....	
		eP_N	16 31 11	.....	.....	.....	.....	
		L_N	16 35 55	.....	.....	.....	.....	
		L_E	16 36 42	.....	.....	.....	.....	
		M_E	16 39 00	15	10	.....	.....	
		C_N	16 42 40	13	.....	.....	.....	
		F_E	16 43 ..	.....	.....	.....	.....	
		F_N	16 47 ..	.....	.....	.....	.....	
18	.....	L_N	13 57 50	.....	.....	.....	.....	
		L_E	13 58 35	.....	.....	.....	.....	
		M_N	14 00 20	11	.....	10	.....	
		M_E	.. .. ..	.....	10	.....	.....	
		C_N	14 02 30	8	.....	.....	.....	
		F_E	14 07 ..	.....	.....	.....	.....	
		F_N	14 09 ..	.....	.....	.....	.....	
22	.....	P_N	22 07 21	3	.....	.....	.....	
		P_E	22 07 25	4	.....	.....	.....	
		S_N	22 11 57	5	.....	.....	.....	
		S_E	22 11 57	.....	.....	.....	.....	
		eL_N	22 14 00	.....	.....	.....	.....	
		L_E	22 14 06	.....	.....	.....	.....	
		M_E	22 14 36	8	30	.....	.....	
		C_E	22 16 15	6	.....	.....	.....	
		M_N	22 23 45	.....	.....	10	.....	
		F_E	22 25 ..	.....	.....	.....	.....	
		F_N	22 28 ..	.....	.....	.....	.....	
31	.....	iP_E	22 12 43	4	.....	.....	.....	
		iP_N	22 12 45	4	.....	.....	.....	
		eL_N	22 16 05	.....	.....	.....	.....	
		M_E	.. .. ..	.....	10	.....	.....	
		F_E	22 17 ..	.....	.....	.....	.....	
		F_N	22 19 ..	.....	.....	.....	.....	

Period of pendulum: E. 15 sec., N. 15 sec.

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.

Instruments: Two Bosch-Omori 100 kg. horizontal pendulums (mechanical registration

Instrumental constants..		V	T_0	e
	E	80	23	0
	N	80	25	4:1

(Report for July, 1919, nor received.)

Missouri. *Saint 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	T_0	e
	80	7	5:1

(Report for July, 1919, not received.)

New York. *Ithaca. Cornell University.* Heinrich Ries.

Lat., 42° 26′ 58″ N.; long., 76° 29′ 09″ W. Elevation, 242.6 meters.

Instruments: Two Bosch-Omori, 25 kg., horizontal pendulums (mechanical registration)

Instrumental constants..		V	T_0	e
	E	13	22	4:1
	N	14	25	4:1

(Report for July, 1919, not received.)

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

Lat., 40° 51′ 47″ N.; long., 73° 53′ 08″ W. Elevation, 23.9 meters.

Instrument: Wiechert, 80 kg.

Instrumental constants..		V	T_0	e
	E	72	5.0	0
	N	72	5.0	0

(Report for July, 1919, not received.)

Panama Canal Zone. *Balboa Heights.* Governor, Panama Canal.

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

Instruments: Two Bosch-Omori, 100 kg.

Instrumental constants..	V	T_0
	.35	20

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1914.			*H. m. s.*	*Sec.*	μ	μ	*km.*	
July 10	.....	P_E	19 32 44	.....	.....	.....	825	Direction uncertain.
		P_N	19 33 04	.....	.....	.....	.....	
		S_N	19 34 04	.....	.....	.....	.....	
		S_E	19 34 08	.....	.....	.....	.....	
		L_N	19 34 44	20	.....	.....	.....	
		L_E	19 34 48	20	.....	.....	.....	
		M_N	19 34 59	.....	.....	*5,000	.....	
		M_E	19 36 28	.....	*3,500	.....	.....	
		F	19 53	.....	.....	.....	.....	
11	.....	M_E	4 11 35	20	.....	.....	.....	Trace, indistinct.
		M_N	4 13 13	20	.....	.....	.....	
		F	4 20 ..	.....	.....	.....	.....	
17	.....	P_E	16 22 04	.....	.....	.....	1,140	Direction uncertain.
		P_N	16 22 14	.....	.....	.....	.....	
		S_E	16 23 52	.....	.....	.....	.....	
		L_E	16 25 32	20	.....	.....	.....	
		L_N	16 25 36	20	.....	.....	.....	
		M_N	16 25 44	.....	.....	*1,200	.....	
		M_E	16 25 50	.....	*1,000	.....	.....	
		F_N	16 33 ..	.....	.....	.....	.....	
		F_E	16 33 24	.....	.....	.....	.....	
22	.....	P_E	22 02 24	.....	.....	.....	685	
		P_N	22 02 26	.....	.....	.....	.....	
		L_E	22 02 28	20	.....	.....	.....	
		L_N	22 03 54	20	.....	.....	.....	Do.
		M_E	22 02 37	.....	*2,200	.....	.....	
		M_N	22 04 02	.....	.....	*1,800	.....	
		F_E	22 13 ..	.....	.....	.....	.....	
		F_N	22 14 ..	.....	.....	.....	.....	

*Trace amplitude.

Porto Rico. *Vieques. Magnetic Observatory.* U. S. Coast and Geodetic Survey. W. M. Hill.

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

Instruments: Two Bosch-Omori.

Instrumental constants..		V	T_0
	E	10	17
	N	10	19

1919.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
July 6	.....	eP_E	7 13 05	.....	.....	.....	.....	
		L_N	7 16 18	.....	.....	.....	.....	
		eL_E	7 18 15	.....	.....	.....	.....	
		M_N	7 16 34	.....	.....	10	.....	
		M_E	.....	.....	10	.....	.....	
		F_N	7 22 ..	.....	.....	.....	.....	
		F_E	7 25 ..	.....	.....	.....	.....	
8	.....	eL_E	21 54 10	.....	.....	.....	.....	Not recognizable on N component.
		M_E	21 59 10	20	20	.....	.....	
		C_E	22 01 15	20	.....	.....	.....	
		F_E	22 09 ..	.....	.....	.....	.....	
11	.....	eP_N	0 35 57	.....	.....	.....	.....	Both P and L difficult. Only a trace on N component.
		eP_E	0 36 31	.....	.....	.....	.....	
		L_E?	0 37 38	.....	.....	.....	.....	
		L_E	0 38 48	.....	.....	.....	.....	
		M_E	0 38 58	19	10	.....	.....	
		C_E	0 41 ..	.....	.....	.....	.....	
		F_E	0 45 ..	.....	.....	.....	.....	
		F_N	0 50 ..	.....	.....	.....	.....	
17	.....	P_E?	16 27 50	.....	.....	.....	.....	P faint and difficult. No trace on N component.
		L_E	16 35 43	.....	.....	.....	.....	
		M_E	16 36 53	17	10	.....	.....	
		C_E	16 40 ..	14	.....	.....	.....	
		F_E	16, 45 ..	.....	.....	.....	.....	
22	.....	iP_N	22 06 06	.....	.....	.....	.....	No long waves on N component.
		IP_E	22 06 08	.....	.....	.....	.....	
		L_E	22 10 48	.....	.....	.....	.....	
		M_E	22 12 43	13	10	.....	.....	
		C_E	22 14 ..	.....	.....	.....	.....	
		F_N	22 13 ..	.....	.....	.....	.....	
		F_E	22 21 ..	.....	.....	.....	.....	

Period of pendulum: E. 17 sec., N. 20 sec.

TABLE 2.—*Instrumental seismological reports, 1919*—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.. $\begin{cases} E & V = 10 & T_0 = 15 \\ N & 10 & 16 \end{cases}$

Date.	Character.	Phase.	Time.	Period T.	Amplitude. Aa	Amplitude. An	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
July 6	.....	e.....	7 12 10	.....	.....	.....	.....	
	.....	L.....	7 18 30	.....	.....	.....	.....	
	.....	F?....	7 30 ..	.....	.....	.....	.....	
9	.....	eL....	19 43 ..	.....	.....	.....	.....	
	.....	F.....	20 00 ..	.....	.....	.....	.....	
22	.....	P.....	22 08 01	.....	.....	.....	3,540	
	.....	S.....	22 13 21	.....	.....	.....	.....	
	.....	eL?...	22 17 ..	.....	.....	.....	.....	
	.....	F.....	22 25 ..	.....	.....	.....	.....	
31	.....	e.....	22 10 50	.....	.....	.....	.....	
	.....	F.....	22 17 ..	.....	.....	.....	.....	

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. Aa	Amplitude. An	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
July 1	.....	e.....	21 37 35	.....	.....	.....	.....	Amplitudes small. Note small periods on the L waves.
	.....	i.....	21 43 16	.....	.....	.....	.....	
	.....	eL?....	21 52 40	.....	.....	.....	.....	
	.....	L.....	21 54 12 to 22 22 ...	8 7.5	.....	.....	.....	
	.....	F.....	22 40....	.....	.....	.....	.....	
2	.....	e?N....	7 54.....	.....	.....	.....	.....	
	.....	eN.....	8 09 30	.....	.....	.....	.....	
	.....	eL?....	8 14.....	7	.....	.....	.....	
	.....	L.....	8 18.....	17	.....	.....	.....	
	.....	L.....	8 30.....	8	.....	.....	.....	
	.....	F.....	8 45.....	.....	.....	.....	.....	
6	.....	O.....	7 04 17	.....	.....	.....	3460	
	.....	P.....	7 10 54	.....	.....	.....	.....	
	.....	S.....	7 16 08	.....	.....	.....	.....	
	.....	eLm....	7 19 24	22	.....	.....	.....	
	.....	L.....	7 25.....	20	.....	.....	.....	
	.....	L.....	7 45.....	8	.....	.....	.....	
	.....	F.....	8 15.....	.....	.....	.....	.....	
7	.....	eL.....	14 50 to 15 00	.....	.....	.....	.....	
8	.....	0?.....	21 13 42	.....	.....	.....	(8080)	
	.....	iP?....	21 25 04	.....	.....	.....	.....	
	.....	e?.....	21 31 54	.....	.....	.....	.....	
	.....	eS?....	21 34 30	10	.....	.....	.....	
	.....	e.....	21 40 24	.....	.....	.....	.....	
	.....	eLN....	21 55.....	.....	.....	.....	.....	
	.....	eL.....	21 58.....	35	.....	.....	.....	
	.....	L.....	22 10.....	18	.....	.....	.....	
	.....	L.....	22 21.....	16	.....	.....	.....	
	.....	Lm.....	22 41.....	17	.....	.....	.....	
	.....	L.....	23 03	15	.....	.....	.....	After 23 hours the amplitudes are so small as to be barely readable.
	.....	F.....	23 40.....	.....	.....	.....	.....	
9	.....	i.....	19 28 16	.....	.....	.....	.....	End of record very faintly marked, irregular periods.
	.....	i.....	19 32 44	.....	.....	.....	.....	
	.....	iN.....	19 35 34	.....	.....	.....	.....	
	.....	eL?....	19 39 48	.....	.....	.....	.....	
	.....	L.....	19 42.....	9	.....	.....	.....	
	.....	L.....	20 00.....	8	.....	.....	.....	
	.....	F.....	20 30.....	.....	.....	.....	.....	
10	.....	eL?m...	2 38 48	.....	.....	.....	.....	
	.....	L.....	2 40 30	8	.....	.....	.....	
	.....	L.....	2 44.....	8	.....	.....	.....	
	.....	F.....	3 05.....	.....	.....	.....	.....	
11	.....	im.....	0 38 11	.....	.....	.....	.....	Very irregular. Wind tremors make record difficult to read.
	.....	iw.....	0 39 33	.....	.....	.....	.....	
	.....	i.....	0 44 20	.....	.....	.....	.....	
	.....	eL?....	0 50 30	.....	.....	.....	.....	
	.....	L.....	0 58.....	15	.....	.....	.....	
	.....	F.....	1 20.....	.....	.....	.....	.....	

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

Date.	Character.	Phase.	Time.	Period T.	Amplitude. Aa	Amplitude. An	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
July 12	.....	e.....	22 38 30	.....	.....	.....	.....	Very small amplitudes; barely discernible.
	.....	eL.....	22 43 30	18	.....	.....	.....	
	.....	F.....	22 55.....	.....	.....	.....	.....	
14	.....	eL?...	14 16.....	28	.....	.....	.....	No indication of P. or S. Local blasting interferes on NS during this record.
	.....	L.....	14 25 ...	15	.....	.....	.....	
	.....	F.....	14 50.....	.....	.....	.....	.....	
17	.....	L.....	10 52 to 11 10...	16	.....	.....	.....	
17	.....	O.....	16 19 46	.....	.....	.....	3,840	
	.....	iPN....	16 26 52	.....	.....	.....	.....	
	.....	PRIN...	16 28 04	.....	.....	.....	.....	
	.....	PRIN...	16 28 24	.....	.....	.....	.....	
	.....	S.....	16 32 40	.....	.....	.....	.....	
	.....	eL.....	16 38.....	.....	.....	.....	.....	
	.....	L.....	16 40.....	23	.....	.....	.....	
	.....	F.....	17 00.....	.....	.....	.....	.....	
22	.....	O.....	22 01 25	.....	.....	.....	3,500	
	.....	iP?....	22 08 05	.....	.....	.....	.....	
	.....	i.....	22 08 37	.....	.....	.....	.....	
	.....	e.....	22 09 10	.....	.....	.....	.....	
	.....	iS?....	22 13 22	.....	.....	.....	.....	
	.....	e.....	22 14 20	.....	.....	.....	.....	
	.....	i.....	22 16 06	.....	.....	.....	.....	
	.....	eL?...	22 17 30 to 22 25...	6	.....	.....	.....	
	.....	F.....	22 40.....	.....	.....	.....	.....	
24	.....	eN.....	2 16 38	.....	.....	.....	.....	
	.....	eN.....	2 20 24	.....	.....	.....	.....	
	.....	eN.....	2 27 12	.....	.....	.....	.....	
	.....	eL?m...	2 45 30	.....	.....	.....	.....	
	.....	Lm.....	2 50.....	.....	.....	.....	.....	
	.....	L.....	2 55 ...	23	.....	.....	.....	
	.....	L.....	3 00 ...	18	.....	.....	.....	
	.....	L.....	3 05.....	.....	.....	.....	.....	
31	.....	e.....	22 05 12	.....	.....	.....	.....	May not be seismic.
	.....	iN.....	22 08 17	.....	.....	.....	.....	
	.....	e.....	22 09 24	.....	.....	.....	.....	
	.....	eL?....	22 12 00	.....	.....	.....	.....	
	.....	F.....	22 25.....	.....	.....	.....	.....	

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=0.45″.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. Aa	Amplitude. An	Distance.	Remarks.
1919.			*H. m. s.*	μ	μ			
July 1	.....	L.....	21 49 24	.....	.....	.....	.....	Times doubtful.
	.....	L.....	21 58 54	.....	*200	.....	.....	
	.....	F.....	22 23 ..	.....	.....	.....	.....	
2	.....	L.....	8 01 36	.....	*50	.....	.....	
4	.....	.....	.....	.....	.....	.....	.....	Micros after 10h of the 4th to morning of the 5th.
6	.....	P.....	7 11 00?	.....	.....	.....	.....	Micros before P.
	.....	S.....	7 15 36	.....	.....	.....	.....	
	.....	eL.....	7 17 36	.....	.....	.....	.....	
	.....	M.....	7 23 54	.....	*200	.....	.....	
	.....	F.....	7 38 30	.....	.....	.....	.....	
7	.....	L?....	14 57 30?	.....	.....	.....	.....	
	.....	eL.....	15 00 54	.....	.....	.....	.....	
	.....	M.....	15 04 54	.....	*200	.....	.....	Gradual thickening.
	.....	F.....	15 12 54	.....	.....	.....	.....	
8	.....	iL.....	22 01 00	.....	.....	.....	.....	
	.....	eL.....	22 10 42	.....	.....	.....	.....	Earlier phases masked by heavy micros.
	.....	M.....	22 18 06	.....	*5,000	.....	.....	
	.....	F.....	Micros.	.....	.....	.....	.....	Lost in microseisms.
9	.....	.....	.....	.....	.....	.....	.....	Heavy micros going on when quake was recorded at other stations.

* Trace amplitude.

TABLE 2.—*Instrumental seismological reports, 1919*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. Aa	Amplitude. An	Distance.	Remarks.
Canada. *Toronto.. Dominion. Meteorological Service*—Continued.								
10	.....	L.....	2 40 30	.....	*200	.....	.....	Micros going on.
11	.....	L.....	0 46 18	.....	.....	.....	.....	
		L.....	0 49 00	.....	.....	.....	.....	
		M.....	0 56 18	.....	*100	.....	.....	
		F.....	1 26 30	.....	.....	.....	.....	
12	.....	L.....	22 42 06	.....	*100	.....	.....	Small micros going on.
14	.....	e.....	14 13 54?	.....	.....	.....	.....	
		eL.....	14 23 00	.....	.....	.....	.....	
	.....	eL.....	14 31 48	.....	.....	.....	.....	
		M.....	14 38 30	.....	*200	.....	.....	
		F.....	15 03 30	.....	.....	.....	.....	
17	.....	iP.....	16 26 30	.....	.....	.....	.....	
		iP.....	16 30 24	.....	.....	.....	.....	
		eS.....	16 33 54	.....	.....	.....	.....	
		L.....	16 39 24	.....	.....	.....	.....	
		L.....	16 40 36	.....	.....	.....	.....	
		M.....	16 48 42	.....	*300	.....	.....	
		F.....	.....	.....	.....	.....	.....	
18	.....	e(or)L	13 25 00?	.....	.....	.....	.....	Small quake 13_h 40_m 36_s phases interlarded with, while inspecting instrument.
22	.....	P.....	22 08 06?	.....	.....	.....	.....	
		iP.....	22 11 30	.....	.....	.....	.....	
		S.....	22 14 00	.....	.....	.....	.....	
		eL.....	22 19 48	.....	.....	.....	.....	
		M.....	22 22 12	.....	*200	.....	.....	
		F.....	.....	.....	.....	.....	.....	Lost in microseisms.
24	.....	e.....	2 47 42	.....	.....	.....	.....	
		e.....	2 57 06	.....	.....	.....	.....	
		eL.....	3 01 00	.....	.....	.....	.....	
		M.....	3 02 06	.....	*200	.....	.....	
		eL?...	3 15 48	.....	.....	.....	.....	
		F.....	3 27 18?	.....	.....	.....	.....	
25	.....	L.....	19 13 48?	.....	.....	.....	.....	Marked micros going on.
		L.....	19 19 36	.....	*200	.....	.....	
31	.....	eL.....	8 06 36	.....	.....	.....	.....	
		M.....	8 10 30 8 12 24	.....	*200	.....	.....	Gradual thickening.
		F.....	8 18 18	.....	.....	.....	.....	
31	.....	L.....	22 05 54	.....	.....	.....	.....	
		L.....	22 12 30	.....	*100	.....	.....	
		F.....	.....	.....	.....	.....	.....	Lost in microseisms.

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

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

Instrument: Wiechert, vertical; Milne horizontal pendulum, North. In the meridian T_0

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

1919.								
July 1	.....	P.....	21 50 29	.....	.....	.....	.....	.....
		M.....	21 51 58	.....	*500	.....	.....	
		F.....	22 01 19	.....	.....	.....	.....	
1	.....	P.....	22 05 15	.....	.....	.....	.....	
		L.....	22 06 14	.....	.....	.....	.....	
		M.....	22 07 13	.....	*500	.....	.....	
		F.....	22 12 08	.....	.....	.....	.....	
2	.....	L.....	8 25 12	.....	*50	.....	.....	
		F.....	8 29 36	.....	.....	.....	.....	
6	.....	P?.....	7 15 53	.....	.....	.....	1,940?	
		S.....	7 19 11	.....	.....	.....	.....	
		L.....	7 24 49	.....	.....	.....	.....	
		M.....	7 28 47	.....	*200	.....	.....	
		F.....	7 41 09	.....	.....	.....	.....	

* Trace amplitude.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. Aa	Amplitude. An	Distance.	Remarks.
Canada. *Victoria*, B. C.. *Dominion Met eorological Service*—Contd.								
7	.....	P?.....	14 21 47	.....	.....	.....	.....	
		L.....	14 35 17	.....	.....	.....	.....	
		M.....	14 43 47	.....	*400	.....	.....	
		F.....	14 59 47	.....	.....	.....	.....	
8	.....	.....	.....	.....	.....	.....	.....	Quake missed, light off the paper.
9	.....	P.....	19 35 18	.....	.....	.....	1,410?	
		S?.....	19 37 46	.....	.....	.....	.....	
		L.....	19 38 44	.....	.....	.....	.....	
		M.....	19 01 22	.....	*400	.....	.....	
		F.....	19 48 34	.....	.....	.....	.....	
10	.....	P.....	2 23 03	.....	.....	.....	.....	
		L.....	2 23 33	.....	.....	.....	.....	
		M.....	2 24 02	.....	*300	.....	.....	
		F.....	2 33 23	.....	.....	.....	.....	
11	.....	L?.....	1 06 56	.....	.....	.....	.....	
		M.....	1 14 18	.....	*200	.....	.....	
		F.....	1 30 02	.....	.....	.....	.....	
17		S?.....	16 49 48	.....	.....	.....	.....	
		L.....	16 53 14	.....	.....	.....	.....	
		M.....	16 57 10	.....	*400	.....	.....	
		F.....	17 18 49	.....	.....	.....	.....	
18	.....	P.....	13 38 20	.....	.....	.....	.....	
		M.....	13 40 18	.....	*300	.....	.....	
		F.....	13 45 03	.....	.....	.....	.....	
			Vertical.	.....	A_s	.....	.....	
	.....	*P.....*	*13 38 18*	*7*	.....	.....	*600*	
		L.....	*13 39 46*	*6*	.....	.....	.....	
		M.....	*13 40 36*	*6*	*7*	.....	.....	
		F.....	*13 49 46*	.....	.....	.....	.....	
22	.....	L?.....	22 35 02	.....	.....	.....	.....	
		M.....	22 38 58	.....	*200	.....	.....	
		F.....	22 42 54	.....	.....	.....	.....	
24	.....	P.....	2 45 16?	.....	.....	.....	.....	
		L.....	2 50 13	.....	.....	.....	.....	
		M.....	3 04 07	.....	*400	.....	.....	
		F.....	3 23 22	.....	.....	.....	.....	
25	.....	L.....	19 16 37?	.....	.....	.....	.....	
		M.....	19 20 35	.....	*400	.....	.....	
		F.....	19 25 03	.....	.....	.....	.....	
31	.....	M.....	7 50 57	.....	*200	.....	.....	
		F.....	8 25 52	.....	.....	.....	.....	
31	.....	L.....	21 58 25	.....	.....	.....	.....	
		M.....	22 00 43	.....	*50	.....	.....	
		F.....	22 06 19	.....	.....	.....	.....	

* Trace amplitude.

SEISMOLOGICAL DISPATCHES.[1]

Guatemala City, Guatemala, July 24, 1919.

A dispatch sent to La Republica, a local paper, states that in the neighborhood of the city of St. Mark, Haiti, a rising of the earth had occurred, forming a small hill. This took place on July 22.

Guatemala City, Guatemala, July 24, 1919.

A communication received to-day at this city reports that on the afternoon of July 22 a strong shock was felt. Also that the Santa Ana volcano had become active. In the Fonseca Bay a small island has appeared.

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

SEISMOLOGY.

TABLE 1.—*Noninstrumental earthquake reports, August, 1919.*

Day.	Approximate time, Greenwich Civil.	Station.	Approximate latitude.	Approximate longitude.	Intensity Rossi-Forel.	Number of shocks.	Duration.	Sounds.	Remarks.	Observer.
		CALIFORNIA.								
	H. m.		° ′	° ′			*Sec.*			
1	12 10	Glennville	35 45	118 42	3	2	Few	Faint	Slight rattle of windows	C. H. Likely.
10	4 50	Berkeley	37 22	118 24	3	2	1	None	Felt by several	William Barth.
26	12 15	Ojai	34 25	119 12	3	3	2	Rattling	Felt by many	Wm. H. Duncan.
26	12 13	San Luis Obispo	35 17	120 40	3	1	1	None	Felt by several	U. S. Weather Bureau.
28	15 00	Ojai	34 25	119 12	3	1		None	Felt by several	Wm. H. Duncan.

TABLE 2.—*Instrumental seismological reports, August, 1919.*

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

[For significance of symbols see REVIEW for January, 1919, p. 59.]

Alabama. *Mobile. Spring Hill College.* Earthquake Station. Cyril Ruhlmann, S. J.

Lat., 30° 41′ 44″ N.; long., 88° 08′ 46″ W. Elevation, 60 meters.

Instrument: Wiechert 80 kg.; astatic, horizontal pendulum.

(No earthquake recorded during August, 1919.)

Alaska. *Sitka. Magnetic Observatory.* U. S. Coast and Geodetic Survey. F. P. Ulrich.

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

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

Instrumental constants..		*V*	T_0
	E	10	17
	N	10	15

No earthquake recorded during August, 1919.

Arizona. *Tucson. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Wm. H. Cullum.

Lat., 32° 14′ 48″ N.; long., 110° 50′ 06″ W. Elevation, 789.6 meters.

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

Instrumental constants..		*V*	T_0
	E	10	15
	N	10	18

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*Km.*	
Aug. 29	.....	L_E	6 38 50	23	.....	.....	.....	N. — not in operation from 23d to 31st
		M_E	6 48 20	20	20	.....	.....	
		C_E	7 00 ..	18	.....	.....	.....	
		F_E	7 11 ..	.....	.....	.....	.....	
29	.....	e_E	23 10 30	4	10	.....	.....	Slight near-by shock.
		F_E	23 16 ..	.....	.....	.....	.....	
31	.....	P_E	17 34 01	4	.....	.....	.....	
		eS_E	17 45 01	.....	.....	.....	.....	
		eL_E	18 07 20	.....	.....	.....	.....	
		M_E	18 15 20	17	10	.....	.....	
		C_E	18 20 ..	16	.....	.....	.....	
		F_E	18 31 ..	15	.....	.....	.....	

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.)

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ 100	μ 100	*Km.*	
Aug. 21	.....	.....	.....	.....	.....	.....	.....	Tremors during 24 hours proceeding $15^h\ 00^m$ on date given.

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.

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.		Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*Km.*	
Aug. 9	u. e.	L	5 21 ..	.....	.....	.....	.....	Sinusoidal.
		F	5 24 ..	.....	.....	.....	.....	
10	.....	.....	3 to 5	.....	.....	.....	.....	Activity. Stronger on N–S.
22	.....	.....	3 to 9	.....	.....	.....	.....	Activity on E–W.
27-28	.....	.....	11 to 1	.....	.....	.....	.....	Activity on E–W. Sinusoidal; long period; small amplitude.
31	.....	.....	.....	.....	.....	.....	.....	Waves at intervals during the day.

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*	T_0
	110	6.4

Date.		Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. M. S.	*Sec.*	μ	μ	*Km.*	
Aug. 8	.....	P	5 11 22	.....	.....	.....	6,480	L undiscernible.
		S	5 19 24	.....	.....	.....	.....	
		F	5 30 ..	.....	.....	.....	.....	
18	.....	e	17 21 05	.....	.....	.....	.....	
		L	17 39 50	20	.....	.....	.....	
		F	17 55 ..	.....	.....	.....	.....	
22	.....	P	8 55 07	.....	.....	.....	1,990?	
		S?	8 58 25	.....	.....	.....	.....	
		F	9 05 ..	.....	.....	.....	.....	
24	.....	e	5 25 ca	.....	.....	.....	.....	Amplitudes very small. Phases undeterminable
		F	5 50 ..	.....	.....	.....	.....	
29	.....	eP	6 06 22	.....	.....	.....	5,140?	
		S?	6 13 12	.....	.....	.....	.....	
		eL	6 21 ..	.....	.....	.....	.....	
		L	6 56 ..	20	.....	.....	.....	
		F	7 35 ..	.....	.....	.....	.....	
30	.....	P?	6 09 36	.....	.....	.....	.....	
		S?	6 13 20	.....	.....	.....	.....	
		F	6 30 ..	.....	.....	.....	.....	
31	.....	P	17 40?..	.....	.....	.....	.....	Small amplitude lasting about one hour. Clock not running.

TABLE 2.—*Instrumental seismological reports, August, 1919*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
District of Columbia. *Washington. Georgetown University.* F. A. 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: E 165, N 143, Z *80*; T_0: 5.4, 5.2, *3.0*; ε: 0, 0, *0*				
			H. m. s.	*Sec.*	*μ*	*μ*	*Km.*	
Aug. 24	.....	e.....	5 31 26	.....	.....	.....	.....	Heavy microseisms.
		eL_E?..	5 40 12	8	.....	.....	.....	
		F.....	6 15 ..	.....	.....	.....	.....	
27	.....	e.....	5 39 ..	.....	.....	.....	.....	Heavy microseisms.
		L.....	6 25 25	16	.....	.....	.....	
		F.....	6 47 ..	.....	.....	.....	.....	
Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Frank Neumann.								
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..18.4. Sensitivity, 0.40″.				T_0				
(Report for August, 1919, not received.)								
Illinois. *Chicago.* University of Chicago. U. S. Weather Bureau.								
Lat., 41° 47′ N.; long., 87° 37′ W. Elevation, 180.1 meters.								
Instruments: Two Milne-Shaw horizontal pendulums, 0.45 kg.								
Instrumental constants..				V: E. 150, N. 150; T_0: 12, 8; ε: 20:1, 20:1; Sensivity.: 1″ arc tilt=26.6 mm., 1″ arc tilt=13.2 mm.				
			H. M. S.	*Sec.*	*μ*	*μ*	*Km.*	
Aug. 2	.....	eP?...	22 59 ca	.....	.....	.....	.....	
	.....	S.....	23 02 50	.....	.....	.....	.....	
	.....	L.....	23 05 20	.....	.....	.....	.....	
	.....	F.....	23 20 ..	.....	.....	.....	.....	
3	.....	eL.....	16 34 ..	.....	.....	.....	.....	
	.....	F.....	17 30 ..	.....	.....	.....	.....	
3	.....	e?	18 33 ..	.....	.....	.....	.....	
	.....	L.....	18 50 ..	.....	.....	.....	.....	
	.....	L.....	19 00 ..	18	.....	.....	.....	
	.....	F.....	*20 10* ..	.....	.....	.....	.....	
8	.....	P.....	5 11 38	.....	.....	.....	7080	
	.....	S.....	5 20 11	.....	.....	.....	.....	
	.....	eL?....	5 33 ..	.....	.....	.....	.....	
	.....	L.....	5 36 ..	25	.....	.....	.....	
	.....	L.....	5 42 30	18	.....	.....	.....	
	.....	F.....	6 10 ca	.....	.....	.....	.....	
15	.....	eP.....	4 30 05	.....	.....	.....	9,000	
	.....	S.....	4 40 15	.....	.....	.....	.....	
	.....	L.....	4 53 20	.....	.....	.....	.....	
	.....	F.....	5 20 ..	.....	.....	.....	.....	
18	.....	e.....	11 31 ..	.....	.....	.....	.....	
	.....	eL.....	11 36 40	.....	.....	.....	.....	
	.....	F.....	11 50 ..	.....	.....	.....	.....	
18	.....	P?....	17 05 49	.....	.....	.....	13,000?	
	.....	S.....	17 18 55	.....	.....	.....	.....	
	.....	L?....	17 31 ..	.....	.....	.....	.....	
	.....	L.....	17 50 30	20	.....	.....	.....	
	.....	L.....	18 10 ..	15	.....	.....	.....	
	.....	F.....	19 00 ..	.....	.....	.....	.....	
18	.....	eL.....	21 44 ..	.....	.....	.....	.....	
	.....	L.....	21 50 ..	18	.....	.....	.....	
	.....	L.....	21 56 ..	15	.....	.....	.....	
	.....	F.....	22 30 ..	.....	.....	.....	.....	
22	.....	P.....	8 56 17	.....	.....	.....	4,170	
	.....	S.....	9 01 14	.....	.....	.....	.....	
	.....	L?....	9 05 22	.....	.....	.....	.....	

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
Illinois. *Chicago. University of Chicago*—Continued.								
			H. m. s.	*Sec.*	*μ*	*μ*	*Km.*	
Aug. 24	.....	e.....	5 24 44	.....	.....	.....	.....	Amplitude small.
	.....	F.....	5 30 ..	.....	.....	.....	.....	Phases indeterminate.
24	.....	e.....	12 51 15	.....	.....	.....	.....	Amplitude small.
	.....	F.....	13 15 ca	.....	.....	.....	.....	Phases indeterminate.
24	.....	eL.....	19 51 ca	.....	.....	.....	.....	
	.....	F.....	20 00 ..	.....	.....	.....	.....	
27	.....	P.....	5 45 45	.....	.....	.....	5,830?	
	.....	S?....	5 53 12	.....	.....	.....	.....	
	.....	L.....	6 01 45	.....	.....	.....	.....	
	.....	L.....	6 12 ..	20	.....	.....	.....	
	.....	L.....	*6 25* ..	*18*	.....	.....	.....	
	.....	L.....	6 31 ..	15	.....	.....	.....	
	.....	F.....	8 00 ca	.....	.....	.....	.....	
29	.....	P.....	6 05 17	.....	.....	.....	5,190	
	.....	S.....	6 12 10	.....	.....	.....	.....	
	.....	L?....	6 19 10	.....	.....	.....	.....	
	.....	L.....	6 22 45	18	.....	.....	.....	
	.....	L.....	6 46 ..	60	.....	.....	.....	
	.....	L.....	6 52 ..	20	.....	.....	.....	
	.....	L.....	7 01 ..	16	.....	.....	.....	
	.....	F.....	8 30 ..	.....	.....	.....	.....	
30	.....	P?....	6 09 36	.....	.....	.....	.....	
	.....	S?....	6 15 17	.....	.....	.....	.....	
	.....	L?....	6 20 20	.....	.....	.....	.....	
	.....	F.....	7 00 ..	.....	.....	.....	.....	
31	.....	e.....	0 51 20	.....	.....	.....	.....	
	.....	F.....	1 10 ..	.....	.....	.....	.....	
31	.....	P.....	17 39 12	.....	.....	.....	9,010	
	.....	PR....	17 46 03	.....	.....	.....	.....	
	.....	*S*.....	*17 49 05*	.....	.....	.....	.....	
	.....	L.....	18 18 25	.....	.....	.....	.....	
	.....	L.....	18 20 ..	18	.....	.....	.....	
	.....	L.....	18 40 ..	16	.....	.....	.....	
	.....	F.....	20 20 ca	.....	.....	.....	.....	
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..				V: E 177, N 205; T_0: 3.4, 3.4; ε: 4:1, 4:1				
(Report for August, 1919, not received.)								
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 Bosoh-Omori, 10 and 12 kg.								
Instrumental constants..				V: E 10, N 10; T_0: 14, 14				
			H. m. s.	*Sec.*	*μ*	*μ*	*Km.*	
Aug. 29	.....	eP_E...	6 06 31	.....	.....	.....	.....	L_N is doubtful; it may come three minutes or more earlier.
		eP_N...	6 06 38	.....	.....	.....	.....	
		eL_E...	6 56 20	.....	.....	.....	.....	
		eL_N...	6 55 20	25	.....	.....	.....	
		M_N....	7 06 25	20	.....	10	.....	
		C_N....	7 18 ..	17	.....	.....	.....	
		F_E....	7 05 ..	.....	.....	.....	.....	
		F_N....	7 50 ..	.....	.....	.....	.....	
31	.....	P_E....	17 40 53	5	.....	.....	.....	
		eP_N...	17 41 25	.....	.....	.....	.....	
		S_E....	17 50 33	8	.....	.....	.....	
		eL_E...	18 27 40	.....	.....	.....	.....	
		eL_N...	18 12 30	28	.....	.....	.....	
		M_E....	18 31 35	18	.....	.....	.....	
		M_N....	18 39 ..	18	.....	.....	.....	
		F_E....	18 42 ..	.....	.....	.....	.....	
		F_N....	18 59 ..	.....	.....	.....	.....	

TABLE 2.—*Instrumental seismological reports, August, 1919*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

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.

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

Instrumental constants.		V	T_0	ε
	E	80	23	0
	N	50	25	4:1

(Report for August, 1919, not received.)

Missouri. *Saint 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	T_0	ε
	80	7	5:1

(Report for August, 1919, not received.)

New York. *Ithaca. Cornell University.* Heinrich Ries.

Lat., 42° 26′ 58″ N.; long., 76° 29′ 09″ W. Elevation, 242.6 meters.

Instruments: Two Bosch-Omori, 25 kg., horizontal pendulums (mechanical registration.

Instrumental constants..		V	T_0	ε
	E	13	22	4:1
	N	14	25	4:1

(Report for August, 1919, not received.)

New York. *New York. Fordham University.* D. H. Sullivan, S. J.

Lat., 40° 51′ 47″ N.; long., 73° 53′ 08″ W. Elevation, 23.9 meters.

Instrument: Wiechert, 80 kg.

Instrumental constants..		V	T_0	ε
	E	72	5.0	0
	N	72	5.0	0

(Report for August, 1919, not received.)

Panama Canal Zone. *Balboa Heights.* Governor, Panama Canal.

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

Instruments: Two Bosch-Omori, 100 kg.

Instrumental constants..	V	T_0
	35	20

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*Km.*	
Aug. 19	.....	P	2 11 14	.....	.....	.....	160	
		P_E	2 11 20	.....	.....	.....	.....	
		L	2 11 31	20	.....	.....	.....	
		L_E	2 11 37	20	.....	.....	.....	
		.....	2 11 42	.....	.....	*200	.....	
		M_E	2 11 43	.....	*800	.....	.....	
		F	2 13 45	.....	.....	.....	.....	
		F_E	2 13 50	.....	.....	.....	.....	

*Trace amplitude.

Porto Rico. *Vieques. Magnetic Observatory.* U. S. Coast and Geodetic Survey. W. M. Hill.

Lat., 19° 09′ N.; long., 65° 27′ W. Elevation, 19.8 meters.

Instruments: Two Bosch-Omori.

Instrumental constants..		V	T_0
	E	10	18
	N	10	20

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*Km.*	
Aug. 3	.....	P_E	16 38 26	2	.....	.....	.....	Probably from Porto Rico, N, not registering.
		L_E	16 38 46	.....	.....	.....	.....	
		M_E	16 38 58	.....	60	.....	.....	
		C_E	16 40 ..	.....	.....	.....	.....	
		F_E	16 43 ..	.....	.....	.....	.....	

Porto Rico. *Vievues. Magnetic Observatory*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*Km.*	
Aug. 9	.....	P	11 49 34	.....	20	20	.....	Apparently local.
		F	11 54 ..	.....	.....	.....	.....	
22	.....	iP	8 50 57	2	.....	.....	.....	Probably from Porto Rico.
		L	8 51 20	.....	.....	.....	.....	
		M_E	8 51 34	.....	90	.....	.....	
		M_N	8 51 28	.....	.....	130	.....	
		C	8 55 ..	.....	.....	.....	.....	
		F	8 59 ..	.....	.....	.....	.....	
30	.....	iP	6 04 08	3	.....	.....	.....	Probably from Porto Rico. Felt by a few persons in Vieques.
		eL_E	6 05 12	.....	.....	.....	.....	
		eL_N	6 05 14	.....	.....	.....	.....	
		M_E	6 05 35	.....	110	.....	.....	
		M_N	6 05 38	.....	.....	130	.....	
		C	6 07 ..	5	.....	.....	.....	
		F	6 14 ..	.....	.....	.....	.....	

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..		V	T_0
	E	10	15
	N	10	16

(No earthquakes recorded for August, 1919.)

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 30 kg. vertical seismograph.

Instrumental constants..	V	T_0
	120	26

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*Km.*	
Aug. 18	.....	i_N	5 16 18	.....	.....	.....	.....	May not be seismic.
		e_E	5 16 20	.....	.....	.....	.....	
		i	5 21 32	.....	.....	.....	.....	
		i_N	5 33 28	.....	.....	.....	.....	
		i_E	5 39 34	.....	.....	.....	.....	
		i_N	5 39 38	.....	.....	.....	.....	
		eL	5 42 40 to 5 52 ..	30	.....	.....	.....	
		L_E	6 00 .. to 6 04 ..	16	.....	.....	.....	
		F	6 05 ..	.....	.....	.....	.....	
24	.....	e	5 31 .. to 5 56 ..	6	.....	.....	.....	
		e	5 59 .. to 6 25 ..	7.5	.....	.....	.....	
27	.....	e_E	5 39 44	.....	.....	.....	.....	
		i_N	5 39 45	.....	.....	.....	.....	
		i	5 46 10	.....	.....	.....	.....	
		e_E	5 48 54	.....	.....	.....	.....	
		e_E	5 49 00	.....	.....	.....	.....	
		eL	6 12 10 to 6 26 ..	12.5	.....	.....	.....	
		eL	6 27 04 to 6 37 ..	17	.....	.....	.....	
		eL	6 39 30	20	.....	.....	.....	
		F	6 50 ..	.....	.....	.....	.....	

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=0.45″.

(Report for August, 1919, not received.)

TABLE 2.—*Instrumental seismological reports, August, 1919*—Contd.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

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

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

Instrument: Wiechert, vertical; Milne horizontal pendulum, North. In the meridian.

T_0

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

(Report for August, 1919, not received.)

SEISMOLOGICAL DISPATCHES.[1]

On Board U. S. S. New Mexico, Saturday, Aug 2.

The *New Mexico* trembled from bow to stern as if she had struck an uncharted reef, and the navigating officer sounded "collision quarters" on the flagship's siren. Sailors in the foretop said the basketmasts of the war ships swayed like poplar trees in a gale.

Wireless telephone messages were received from the five other dreadnaughts reporting that they felt the shocks. The *Mississippi*, which was farther offshore, reported heavy vibrations.—*Associated Press.*

On Board U. S. S. New Mexico, Saturday, August 2.

Six dreadnaughts of the Pacific Fleet were shaken severely by a double earthquake shock at 4:18 o'clock this afternoon 20 miles off the coast of the State of Colima, Mexico. None of the warships reported any damage.—*Associated Press.*

Beach Haven, N. J., August 5, 1919.

A shock was felt here about midnight.—*Special Observer.*

LATE REPORTS.

TABLE 3.—*Late reports (instrumental).*

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.

				H. m. s.	Sec.	μ	μ	Km.	
July	3					50	50		Tremors during 24 hours preceding 15h 00m on dates given.
	15					100	100		

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

TABLE 3.—*Late reports (instrumental)*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Frank Neumann.

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.

T_0 ″

Instrumental constant..18.1. Sensitiveness 0.40 are tilt=1 mm.

				H. m. s.	Sec.	μ	μ	Km.	
July	6		eP	7 15 18	18				P is faint and difficult to place definitely.
		!	S	7 23 30					
			L	7 33 24					
			M	7 35 30	20	*200			
			C	7 39 ..	20				
			F	7 49 ..					
	7		eP	14 09 12	18				None of the phases sharply defined.
			eS	14 15 18	17				
			eL	14 19 ..					
			M	14 27 06	16	*500			
			C	14 31 ..	16				
			F	14 51 ..	20				
	8		eP	21 31 00	20				Early portion of record (before L) might be microseisms or caused by minor shocks.
			L	22 38 30					
			M	22 55 00	16				
			C	22 59 ..					
			F	24 12 ..	20				
	14		eP	13 50 18					eP quite faint.
			L	13 59 30					
			M	14 05 00	16	*200			
			C	14 07 ..					
			F	14 57 ..	17				
	16		eP	18 20 54	20				eP quite faint.
			L	18 29 24					
			M	18 32 30	19	*300			
			C	18 35 ..					
			F	19 04 ..					
	24		eP	2 29 42	18				eP quite faint.
			L	3 04 ..					
			M	3 09 00	16	*300			
			C	3 15 ..					
			F	3 31 ..	19				
	25		eP	19 13 42	18				
			L	19 21 ..					
			M	19 26 30		*300			
			C	19 28 24					
			F	19 45 ..	18				
	31		eP	7 15 00	19				eP quite faint.
			L	7 24 01					
			M	7 31 00	19	*400			
			C	7 34 ..	16				
			F	8 09 ..	16				

*Trace amplitude.

SEISMOLOGY.

W. J. HUMPHREYS, Professor in Charge.

[Dated: Weather Bureau, Washington, D. C., Nov. 3, 1919.]

TABLE I.—*Noninstrumental earthquake reports, September, 1919.*

Day.	Approximate time, Greenwich civil.	Station.	Approximate latitude.	Approximate longitude.	Intensity Rossi-Forel.	Number of shocks.	Duration.	Sounds.	Remarks.	Observer.
	H. m.	CALIFORNIA.	° ′	° ′			*Sec.*			
Sept. 4.	20 16	Berkeley	37 51	121 18	3	1	1	None	Felt by many	E. F. Davis.
	20 16	San Francisco	37 48	122 26	3	1		do	Felt by several	U. S. Weather Bureau.
	20 17	Oakland	37 48	122 15	3	1	3	Rattling	Felt by mechanics at work in building.	Chas. Burckhalter.
12	17 07	Eureka	40 48	124 10	4	2	(1)	Faint rumbling	Felt by many	U. S. Weather Bureau.
	19 30	do	40 48	124 10	5	2	1	do	do	Do.
15	14 07	do	40 48	124 10	6	1	2	Building creaked	do	Do.
	16 08	do	40 48	124 10	4	1	5	do	do	Do.
	19 16	do	40 48	124 10	4	2	2	do	do	Do.
30	4 29	Calexico	34 41	115 30	3	1	15	Faint rumbling	do	H. M. Rouse.
	5 04	do	34 41	115 30	2	1	10	None	Felt by several	Do.
	5 06	do	34 41	115 30	3	1	30	Faint rumbling	do	Do.
	7 40	Amos	33 00	115 07	4	2	2	do	do	G. T. Hartsfield.
	8 38	Calexico	34 41	115 30	4	1	45	Loud rumbling	Felt by many	H. M. Rouse.

(1) Fraction of second.

TABLE 2.—*Instrumental seismological reports, September, 1919.*

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

[For significance of symbols see REVIEW for January, 1919, p. 59.]

Alabama. *Mobile. Spring Hill College.* Earthquake Station. Cyril Ruhlmann, S. J.

Lat., 30° 41′ 44″ N.; long., 88° 08′ 46″ W. Elevation, 60 meters.

Instrument: Wiechert 80 kg.; astatic, horizontal pendulum.

(Report for September, 1919, not received.)

Alaska. *Sitka. Magnetic Observatory.* U. S. Coast and Geodetic Survey. F. P. Ulrich.

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

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

Instrumental constants.		V	T_0
	E	10	17
	N	10	15

No earthquake recorded during September, 1919.

Arizona. *Tucson. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Wm. H. Cullum.

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

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

Instrumental constants.		V	T_0
	E	10	15
	N	10	18

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919. Sept. 11	.....	P_E	*H. m. s.* 21 32 05	*Sec.*	μ	μ	*Km.*	Not in operation during September.
		M_E	21 32 28	.....	40	.....	.....	
		F_E	21 36 13	4	.....	.....	.....	
15	.....	eP_E	17 36 15	.....	.....	.....	.....	Probably local.
		L_E	17 37 11	.....	.....	.....	.....	
		M_E	17 38 30	.....	20	.....	.....	
		C	17 40 ..	4	.....	.....	.....	
		F_E	17 50 ..	.....	.....	.....	.....	
19	.....	P_E	3 27 30	5	.....	.....	.....	Probably local.
		eL_E	3 28 59	.....	.....	.....	.....	
		M_E	3 30 ..	9	60	.....	.....	
		F_E	3 33 ..	8	.....	.....	.....	
30	.....	iP_E	7 38 28	1	.....	.....	.....	Local.
		S_E	7 39 06	.....	.....	.....	.....	
		M_E	7 39 55	12	280	.....	.....	
		C	7 44 ..	.....	.....	.....	.....	
		F_E	7 56 ..	4	.....	.....	.....	

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

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.

Sept. 30	.....	.....	*H. m. s.* 8 00 ca	*Sec.*	μ 400	μ 600	*Km.*	Light shock.

Colorado. *Denver. Sacred Heart College.* Earthquake Station. A. W. Forstall, S. J.

Lat., 39° 40′ 36″ N.; long., 104° 58′ 54″ W. Elevation, 1,655 meters.

Instrument: Wiechert 80 kg., astatic, horizontal pendulum.

15	.....	P	16 33 ..	.....	.....	.....	.....	Heavy machinery in motion nearby during first portion of record.
		S	(?)					
		L	16 38 30	4–5	*4,500	*4,500	.....	
		M_N	16 38 ..	.....	.....	*4,500	.....	
		M_E	16 39 ..	.....	*6,500	.....	.....	
		C	16 40 ..	.....	.....	.....	.....	
		F	16 40 30	.....	.....	.....	.....	
20	.....	.....	.....	.....	.....	.....	.....	Waves at intervals during the day.

* Trace amplitude.

TABLE II.—*Instrumental seismological reports, September, 1919*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

District of Columbia. *Washington. Georgetown University.* F. A. 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 pendulum, 80 kg. vertical.

Instrumental constants.. E: V = 165, T_0 = 5.4, ε = 0; N: V = 143, T_0 = 5.2, ε = 0; Z: V = 80, T_0 = 5.0, ε = 0

				H. m. s.	Sec.	μ	μ	Km.	
Sept. 1	.....	L_{EN}		20 06 ..	22	.....	.....	.....	Heavy microseism.
		F		20 10 ..		.....	.....	.....	
6	.....	iP_N		1 45 56		.....	.....	.....	
		eP_N		1 45 56		.....	.....	.....	
		M_E		1 46 12	(†)	.....	500	.....	
		M_N		1 46 14	(†)	300	.....	.....	
		F		1 49 ..		.....	.....	.....	
6	.....	eP_N		9 34 43		.....	.....	.....	
		eP_E		9 34 48		.....	.....	.....	
		iS		9 38 48		.....	.....	.....	
		eL		9 40 42	14	.....	.....	.....	
		L_E		9 41 50	14	.....	.....	.....	
		L		9 42 ..	10	.....	.....	.....	
		F		10 37 ..		.....	.....	.....	
13	.....	e_E		12 28 58		.....	.....	.....	Heavy microseisms difficult to read.
		i_E		12 36 46 to 12 41 37		.....	.....	.....	
		L		12 54 46	17	.....	.....	.....	
		F		13 20 ..		.....	.....	.....	
15	.....	eP?		17 37 24		.....	.....	.....	Heavy microseisms.
		S_E		17 47 57		.....	.....	.....	
		S_N		17 47 59		.....	.....	.....	
		F		18 25 ..		.....	.....	.....	
26	.....	e_E		10 26 41		.....	.....	.....	Very heavy microseisms.
		e_N		10 27 19		.....	.....	.....	F lost in micros.
27	.....	eL_E?		3 48 41	8	.....	.....	.....	Very heavy microseisms.
		L_E		3 52 ..	27	.....	.....	.....	N-S does not show.
		F		4 00 ..		.....	.....	.....	
27	.....	e_E		11 33 48		.....	.....	.....	Very heavy microseisms.
		e_N		11 34 ..		.....	.....	.....	
		F		11 43 ..		.....	.....	.....	
				Vertical.					
15	.....	*iP*		*17 37 37*		.....	.....	.....	
		S		*17 48 27*		.....	.....	.....	
		F		*18 13* ..		.....	.....	.....	

† Less than ½ sec.

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

				H. m. s.	Sec.	μ	μ	Km.	
Sept. 1	.....	eL		20 07 ca	20	.....	.....	.....	Clock stopped.
		F		20 15 ca		.....	.....	.....	
5	.....	P		19 07 22		.....	.....	2,600	
		S		19 11 35		.....	.....	.....	
		eL		*19 17 30*		.....	.....	.....	
		F		19 25 ..		.....	.....	.....	
6	.....	P		1 46 00		.....	*375	.....	Reported near Front Royal, Va.
		S		1 46 08		.....	.....	.....	
		M_E		1 46 16		.....	.....	.....	
		F		1 47 20		.....	.....	.....	
6	.....	P		9 34 50ca		.....	.....	.....	Clock not registering.
		S		9 38 50ca		.....	.....	.....	
		L		9 42 ca		.....	.....	.....	
		L		9 44 50ca		.....	.....	.....	
		F		10 40 ..		.....	.....	.....	
13	.....	P		12 28 57		.....	.....	6,160	
		S		12 36 42		.....	.....	.....	
		L		12 54 ..	16	.....	.....	.....	
		F		13 10 ..		.....	.....	.....	

[1] Dr. T. L. Watson, of the University of Virginia, is preparing for publication elsewhere a report of this earthquake, which occurred at the same place as that of April —, 1918.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

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

				H. m. s.	Sec.	μ	μ	Km.	
Sept. 15	.....	P		17 37 26		.....	.....	.....	
		S		17 42 04		.....	.....	.....	
		M_N		17 48 30		.....	*300	.....	
		L		17 51 50	12	.....	.....	.....	
		F		18 10 ca		.....	.....	.....	
15	.....	e		17 49 30		.....	.....	.....	
		F		18 00 ..		.....	.....	.....	
26	.....	e		9 27 10		.....	.....	.....	
		F		9 40 ca		.....	.....	.....	
26	.....	e		20 00 50		.....	.....	.....	
27	.....	e		3 39 55		.....	.....	.....	Very feeble.
		F		4 05 ..		.....	.....	.....	
27	.....	e		11 33 25		.....	.....	.....	
		F		11 42		.....	.....	.....	
30	.....	e		7 54 30		.....	.....	.....	
		L?		7 55 40		.....	.....	.....	
		F		8 15 ..		.....	.....	.....	

Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Frank Neumann.

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

To

Instrumental constant 18.4. Sensitivity, 0.40″.

				H. m. s.	Sec.	μ	μ	Km.	
Sept. 12	.....	eL		14 17 ..		.....	.....	.....	Preceded and followed by several hours of tremors.
		M		14 22 30	17	.....	*200	.....	
		C		14 25 00		.....	.....	.....	
13	.....	L		12 42 00		.....	.....	.....	*Followed about 20* minutes later by several series of waves and about 4 hours of tremors.
		M		12 44 00	19	.....	*200	.....	
		C		12 47 ..	20	.....	.....	.....	
15	.....	i		3 52 ..		.....	.....	.....	*Volcanic disturbances* on Mauna Loa. Recorded by all three variometers of the magnetograph.
		M		3 53 18		.....	*2,100	.....	
		F		4 04 ..	18	.....	.....	.....	
15	.....	eP		17 50 00		.....	.....	.....	
		L		17 52 48		.....	.....	.....	
		M		17 58 00	19	.....	*300	.....	
		C		17 59 30		.....	.....	.....	
		F		18 28 ..		.....	.....	.....	
18	.....	P		14 11 18		.....	.....	.....	Local shock: recorded by magnetograph. Followed by tremors for about 5 *hours.*
		M		14 12 00		.....	*300	.....	
		C		14 13 18		.....	.....	.....	
		F		14 14 ..		.....	.....	.....	
26	.....	eP		9 28 48		.....	.....	.....	Several irregular series of waves.
		L		9 33 30		.....	.....	.....	
		M		9 56 ..	17	.....	*300	.....	
		F		10 22 ..	18	.....	.....	.....	
26	.....	P		19 52 00		.....	.....	.....	*Secondary maximum* at 22 : 39 and at 23 : 48.
		eL		20 16 06		.....	.....	.....	
		M		20 31 24	19	.....	*1,900	.....	
		C		20 38 30	18	.....	.....	.....	
		F		23 53 ..	18	.....	.....	.....	
27	.....	L		4 10 00		.....	.....	.....	
		M		4 15 38	18	.....	*100	.....	
		C		4 18 30		.....	.....	.....	
		F		4 42 ..		.....	.....	.....	
29	.....	eP		12 37 00		.....	.....	.....	Tremors continue *to next quake.*
		L		12 40 00		.....	.....	.....	
		M		12 40 48	18	.....	*400	.....	
		C		12 44 30		.....	.....	.....	
29	.....	L		13 49 12		.....	.....	.....	Eruption of Mauna Loa.
		M		13 49 42	17	.....	*100	.....	
		C		13 52 ..	19	.....	.....	.....	
		F		14 09 ..		.....	.....	.....	
30	.....	L		7 56 30		.....	.....	.....	
		M		7 59 30	17	.....	*100	.....	
		F		8 04 ..		.....	.....	.....	

* Trace amplitude.

TABLE 2.—Instrumental seismological reports, *September, 1919*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	*μ*	*μ*	*Km.*	
Illinois. *Chicago. University of Chicago.* U. S. Weather Bureau.								
Lat., 41° 47′ N.; long., 87° 37′ W. Elevation 180.1 meters.								
Instruments: Two Milne-Shaw horizontal pendulums, 0.45 kg.								
Instrumental constants...			*V*	T_0	*ε*	Sensitivity.		
			E. 150	12	20:1	1″ arc tilt=26.6 mm.		
			N. 150	8	20:1	1″ arc tilt=13.2 mm.		
Sept. 1		e	13 48 ..					
		L	14 00 ..	20				
		L	14 11 40	15				
		F	14 50 ..					
1		P	19 37?..					
		S	19 45 15					
		L	19 55 ..	35				
		L	20 06 ..	18				
		F	21 50 ..					
5		P?	19 07 26				3,770	
		S	19 13 10					
		Lʳ	19 16 15					
		F	20 ca ..					
6		P	9 35 30				3,540	
		S	9 40 50					
		L	9 44 ..					
		L	10 03 ..	18				
		L	10 20 ..	15				
		F	11 40 ca					
11		P?	14 00 40					Nearly continuous disturbance, may not be seismic.
		S?	14 03 38					
		L	14 05 40					
		L	14 09 05	12				
		F	15 10 ca					
12		P?	14 01 15					
		S?	14 09 32					
		L	14 23 ..					
		L	14 37 ..	18				
		F	15 10 ca					
13		P	12 29 15				7,750	
		S	12 38 22					
		L	12 51 20	22				
		L	12 58 30	15				
		F	15 10 ca					
15		P	17 36 45				3,700	Irregular waves, complicated by strong microseisms.
		S	17 41 15					
		L	17 45 18					
		M	17 47 30					
		F	18 50 ca		*3,500	*3,000		
16		P?	12 04 22					
		S	12 08 53					
		L	12 15 ..					
		L	12 22 ..	22				
		L	12 30 ..	18				
		F	12 50 ..					
19		P	3 22 19				3,980	
		S	3 28 05					
		L	3 33 15	15				
		F	4 10 ca					
26		P	9 26 26				8,200	
		S	9 35 56					
		eL?	9 50 ..					
		L	10 12 ..	22				
		F	11 30 ..					
26		P?	20 00 28					
		S	20 10 10					
		L	21 06 ..					
		F	23 30 ca					
27		P	3 41 17				3,590	
		S	3 45 40					
		eL	3 50 ..					
		F	4 30 ..					
27		P?	11 13 20					
		S	11 21 58					
		L	11 22 15					
		F	11 35 ..					
30		P	7 42 35				2,730	
		S	7 46 58					
		L	7 49 50					
		F	8 40 ..					

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	*μ*	*μ*	*Km.*	
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: Weichert.								
Instrumental constants ..			*V*	T_0	*ε*			
			E 177	3.4	4:1			
			N 205	3.4	4:1			
(Report for September, 1919, not received.)								
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..			*V*	T_0				
			E 10	14				
			N 10	14				
Sept. 6		P	9 34 45	5				
		S	9 38 48					
		M_N	9 39 00			60		
		M_E	9 39 05		80			
		L_E	9 40 40					
		eL_E	9 42 00					
		M_N	9 46 05	13	30			
		M_N	9 49 15	10		20		
		C_N	9 50 ..	10				
		C_E	9 55 ..	10				
		F_E	10 07 ..	10				
		F_N	10 14 ..					
15		eP	17 47 31	5				Uncertain on account of micros.
		L_N	17 49 50					
		L_E	17 50 50					
		M_N	17 50 15	11		30		
		M_E	17 51 10	12	40			
		C	17 52 ..	10				
		F_N	17 56 ..					
		F_E	17 59 ..					
27		eF_E	11 34 03	3				Possibly not seismic.
		eF_N	11 34 28	3				
		F_N	11 38 ..			10		
		F_E	11 39 ..		10			
30		P_N	7 53 42	3				
		eP_E	7 53 46					
		eL_N	7 54 40					
		eL_E	7 57 40					
		M_N	7 54 45	10		30		
		M_E	7 59 05	9	10			
		F	8 03 ..					
Massachusetts. *Cambridge. Harvard University Seismographic Station.* J. B. Woodworth.								
Lat., 42° 22′ 35″ N.; long., 71° 06′ 59″ W. Elevation, 5.4 meters. Foundation: Glacial sand over clay.								
Instruments: Two Bosch-Omori 100 kg. horizontal pendulums (mechanical registration).								
Instrumental constants..			*V*	T_0	*ε*			
			E 80	23	0			
			N 50	25	4:1			
(Report for September, 1919, not received.)								
Missouri. *Saint 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*	T_0	*ε*			
			80	7	5:1			
(Report for September, 1919, not received.)								

TABLE 2.—Instrumental seismological reports, *September, 1919*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

New York. *Ithaca. Cornell University.* Heinrich Ries.

Lat., 42° 26′ 58″ N.; long., 76° 29′ 09″ W. Elevation, 242.6 meters.

Instruments: Two Bosch-Omori 25 kg. horizontal pendulums (mechanical registration).

Instrumental constants..		V	T_0	s
	E	13	22	4:1
	N	14	25	4:1

(Report for September, 1919, not received.)

New York. *New York. Fordham University.* D. H. Sullivan, S. J.

Lat., 40° 51′ 47″ N.; long., 73° 53′ 08″ W. Elevation, 23.9 meters.

Instrument: Wiechert, 80 kg.

Instrumental constants..		V	T_0	s
	E	72	5.0	0
	N	72	5.0	0

(Report for September, 1919, not received.)

Panama, Canal Zone. *Balboa Heights.* Governor, Panama Canal.

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

Instruments: Two Bosch-Omori, 100 kg.

Instrumental constants..	V	T_0
	35	20

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	*μ*	*μ*	*Km.*	
Sept. 27	.....	P_E	3 35 20	.....	.....	.....	595	
		P_N	3 35 24	.....	.....	.....		
		L_E	3 36 37	20	.....	.....		
		L_N	3 36 41	20	.....	.....		
		M_E	3 36 57	.....	500	.....		
		M_N	3 36 58	.....	.....	1,000		
		F_E	3 46 42	.....	.....	.....		
		F_N	3 49 26	.....	.....	.....		

Porto Rico. *Vieques. Magnetic Observatory.* U. S. Coast and Geodetic Survey. W. M. Hill.

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

Instruments: Two Bosch-Omori.

Instrumental constants..		V	T_0
	E	10	17
	N	10	19

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	*μ*	*μ*	*Km.*	
Sept. 5	.....	P.....	19 03 02	.....	.....	.....	.....	Local.
		eL_E...	19 03 15	.....	.....	.....	.....	
		eL_N...	19 03 44	.....	.....	.....	.....	
		M.....	19 04 02	5-10	80	130	.....	
		F.....	19 11 ..	.....	.....	.....	.....	
6	.....	iL.....	9 30 15	.....	.....	.....	.....	Recorded on magnetogram. Probably local.
		M_N....	9 31 18	16	.....	1,890	.....	
		M_E....	9 31 23	16	1,590	.....	.....	
		C.....	9 34 ..	7	.....	.....	.....	
		F.....	10 06 ..	6	.....	.....	.....	
11	.....	P_N....	13 50 10	3	.....	.....	.....	Local.
		P_E....	13 50 13	.....	.....	.....	.....	
		L_E....	13 50 27	.....	.....	.....	.....	
		L_N....	13 50 38	.....	.....	.....	.....	
		M.....	13 50 52	8	90	60	.....	
		C.....	13 52 ..	4	.....	.....	.....	
		F_N....	13 57 ..	4	.....	.....	.....	
		F_E....	14 00 ..	.....	.....	.....	.....	
11	.....	iP_N...	14 13 00	.....	.....	.....	.....	Local.
		P_E....	14 12 01	.....	.....	.....	.....	
		eL_N...	14 12 06	.....	.....	.....	.....	
		eL_E...	14 12 07	.....	.....	.....	.....	
		M.....	14 12 43	8	120	130	.....	
		C.....	14 14 ..	5	.....	.....	.....	
		F_N....	14 19 ..	4	.....	.....	.....	
		F_E....	14 23 ..	4	.....	.....	.....	
13	.....	eP_E...	12 32 00	.....	.....	.....	.....	Times uncertain for lack of time marks. Barely a trace on N-S.
		M_E....	12 38 40	20	20	.....	.....	
		F_E....	12 58 ..	.....	.....	.....	.....	

Porto Rico. *Vieques Magnetic Observatory*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
13	.....	eP_N...	21 49 51	2	.....	.....	.....	Local.
		P_E....	21 49 52	.....	.....	.....	.....	
		L_E....	21 50 09	.....	.....	.....	.....	
		L_N....	21 50 22	.....	.....	.....	.....	
		M.....	21 50 28	7	60	40	.....	
		C.....	21 51 ..	4	.....	.....	.....	
		F.....	21 57 ..	4	.....	.....	.....	
25	.....	iP.....	16 21 46	.....	.....	.....	.....	Local.
		M.....	16 21 48	.....	30	50	.....	
		F.....	16 25 ..	.....	.....	.....	.....	

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..		V	T_0
	E	10	15
	N	10	16

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	*μ*	*μ*	*Km.*	
Sept. 6	.....	e.....	9 38 20	.....	.....	.....	.....	
		S.....	9 39 44	.....	.....	.....	.....	
		eL.....	9 45 ..	.....	.....	.....	.....	
		F.....	10 00 ..	.....	.....	.....	.....	
30	.....	e.....	7 57 ..	.....	.....	.....	.....	
		F.....	8 05 ..	.....	.....	.....	.....	

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	T_0
	120	26

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	*μ*	*μ*	*Km.*	
Sept. 1	.....	e_N.....	19 30 36 to 20 00 ..	.....	.....	.....	.....	
		eL_E...	20 06 ..	.....	.....	.....	.....	
		eL_E...	20 10 .. to 20 25 ..	18	.....	.....	.....	
6	.....	eL?....	9 40 18 to 10 00 ..	11	.....	.....	.....	Early phases lost in microseisms L waves very irregular.
		L?.....	10 16 ..	13	.....	.....	.....	Very irregular.
		F.....	10 40 ..	.....	.....	.....	.....	
13	.....	i_V.....	12 21 40	.....	.....	.....	.....	Character of L waves not sinusoidal. Very irregular. Do not resemble usual earthquake records.
		i_N.....	12 29 40	5	.....	.....	.....	
		i_E.....	12 38 04	9	.....	.....	.....	
		$eL?_E$..	12 45 ..	.....	.....	.....	.....	
		L_E....	12 50 ..	28	.....	.....	.....	
		L.....	12 56 ..	18	.....	.....	.....	
		F.....	13 33 ..	.....	.....	.....	.....	
15	.....	i_E.....	17 39 14	.....	.....	.....	.....	Heavy microseisms.
		e_N.....	17 49 20 to 18 00 ..	6	.....	.....	.....	
		F.....	18 10 ..	.....	.....	.....	.....	
19	.....	e_E.....	3 29 ..	.....	.....	.....	.....	Small waves resembling large micros.
		e_N.....	3 40 .. to 4 00 ..	.....	.....	.....	.....	
25	.....	i_E?....	9 26 20	.....	.....	.....	.....	The first impulse may not be due to the earthquake. It appears isolated from the L waves.
		eL_N?..	10 06 .. to 10 10 ..	.....	.....	.....	.....	
		L.....	10 16 .. to 10 25 ..	18	.....	.....	.....	
26	.....	eL.....	20 36 .. to 20 42 ..	30	.....	.....	.....	Preceded by slight tremblings extending over several hours. No trace of phase. May be micros. L waves are certainly seismic.
		L.....	20 47 ..	.....	.....	.....	.....	
		L.....	to 20 55 ..	25	.....	.....	.....	
		L.....	21 00 .. to 21 05 ..	22	.....	.....	.....	

TABLE 2.—*Instrumental seismological reports; September, 1919*—Continued

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
Canada. *Ottawa. Dominion Astronomical Observatory*—Continued.								
26	.....	L.....	21 07 .. to 21 16 ..	17	.....	.....	.....	
		L.....	21 20 .. to 21 25 ..	17	.....	.....	.....	
		F.....	21 50 ..	.....	.....	.....	.....	
27	.....	Of.....	3 34 32	.....	.....	.....	4,050	
		ePf_m....	3 41 56	.....	.....	.....	.....	
		PR_1.....	3 43 36	.....	.....	.....	.....	
		eS_m?....	3 47 48	.....	.....	.....	.....	
		eL.....	3 55 ..	22	.....	.....	.....	
		L_m.....	4 00 .. to 4 05 ..	20	.....	.....	.....	
		L.....	4 20 .. to 4 25 ..	17	.....	.....	.....	
		F.....	4 30 ..	.....	.....	.....	.....	

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=0.45″.

	Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
				H. m. s.	*Sec.*	*μ*	*μ*	*Km.*	
Sept.	1	.....	L?.....	20 10 10	.....	*100	.....	.....	icros going on.
	6	.....	S?.....	9 36 00	.....	.....	.....	.....	
			L.....	9 41 06	.....	.....	.....	.....	
			eL.....	9 43 36	.....	.....	.....	.....	
			M.....	9 45 00	.....	*1,700	.....	.....	
			F.....	10 37 54	.....	.....	.....	.....	
	13	.....	L.....	11 37 12	.....	.....	.....	.....	Doubtful as to being seismic.
			eL.....	11 39 36	.....	.....	.....	.....	
			M.....	11 40 30	.....	.....	.....	.....	
			F.....	11 46 30	.....	.....	.....	.....	
	13	.....	i.....	12 19 06	.....	.....	.....	.....	Very difficult seismogram to read.
			i.....	12 20 48	.....	.....	.....	.....	
			S?.....	12 25 18	.....	.....	.....	.....	
			L.....	12 34 24	.....	.....	.....	.....	
			L.....	12 38 30	.....	.....	.....	.....	
			L.....	12 45 06	.....	.....	.....	.....	
			L.....	12 53 54	.....	.....	.....	.....	
			eL.....	12 55 48	.....	.....	.....	.....	
			M.....	12 57 24	.....	*800	.....	.....	
	13	.....	L.....	14 21 42	.....	.....	.....	.....	Doubtful, but some strong seismic features.
			eL.....	14 37 18	.....	*200	.....	.....	
			M.....	14 37 42	.....	.....	.....	.....	
	15	.....	e.....	17 44 24	.....	.....	.....	.....	
			eL.....	17 48 48	.....	.....	.....	.....	
			M.....	17 52 30	.....	*300	.....	.....	Micros going on.
			F.....	Micros.	.....	.....	.....	.....	
	19	.....	L.....	3 28 42?	.....	.....	.....	.....	
			L.....	3 31 24?	.....	*50	.....	.....	
	22	.....	L.....	11 40 06	.....	*200	.....	.....	Doubtful as to being seismic.
	26	.....	e.....	9 28 24?	.....	.....	.....	.....	
			L.....	9 37 06	.....	*100	.....	.....	Do.
			L.....	9 40 42	.....	.....	.....	.....	
	26	.....	L.....	21 00 12	.....	.....	.....	.....	
			L.....	21 07 48	.....	.....	.....	.....	
			eL.....	21 10 00	.....	.....	.....	.....	
			M.....	21 11 24	.....	*300	.....	.....	
			L.....	21 25 36	.....	.....	.....	.....	
	27	.....	M.....	4 08 23	.....	*100	.....	.....	
			F.....	4 14 46	.....	.....	.....	.....	
	27	.....	i.....	3 51 18	.....	.....	.....	.....	
			L.....	3 52 48	.....	.....	.....	.....	
			eL.....	3 53 48	.....	.....	.....	.....	
			M.....	3 57 42	.....	*800	.....	.....	
			F.....	4 21 42	.....	.....	.....	.....	
	30	.....	L.....	7 53 25	.....	*500	.....	.....	
			F.....	8 01 18	.....	.....	.....	.....	

*Trace amplitude.

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

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

Instrument: 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.
				H. m. s.	*Sec.*	*μ*	*μ*	*Km.*	
Sept.	1	.....	L.....	20 04 46	.....	.....	.....	.....	
			M.....	20 07 13	.....	*300	.....	.....	
			F.....	20 13 07	.....	.....	.....	.....	
	6	.....	P.....	9 49 48	.....	.....	.....	.....	
			L.....	9 58 10	.....	.....	.....	.....	
			M.....	10 05 04	.....	*500	.....	.....	
			F.....	10 38 50	.....	.....	.....	.....	
	13	.....	P.....	12 32 30	.....	.....	.....	.....	
			S.....	12 41 21	.....	.....	.....	.....	
			L.....	12 53 39	.....	.....	.....	.....	
			M.....	13 11 22	.....	*500	.....	.....	
			F.....	13 58 34	.....	.....	.....	.....	
	15	.....	P.....	17 46 20	.....	.....	.....	.....	Off coast of California.
			S.....	17 47 19	.....	.....	.....	.....	
			L.....	17 49 08	.....	.....	.....	.....	
			M.....	17 50 46	.....	*400	.....	.....	
			F.....	17 59 38	.....	.....	.....	.....	
	19	.....	M.....	3 40 11	.....	*200	.....	.....	
			F.....	3 49 02	.....	.....	.....	.....	
	22	.....	L.....	11 36 32	.....	*50	.....	.....	Doubtful as to being seismic.
	26	.....	L.....	20 04 50	.....	.....	.....	.....	
			M.....	20 13 41	.....	.....	.....	.....	
			F.....	22 07 47	.....	*400	.....	.....	Probably Honolulu.
	27	.....	M.....	4 08 23	.....	*100	.....	.....	
			F.....	4 14 46	.....	.....	.....	.....	
	30	.....	P.....	7 45 52	.....	.....	.....	.....	
			L.....	7 47 50	.....	.....	.....	.....	
			M.....	7 49 17	.....	*300	.....	.....	
			F.....	7 54 12	.....	.....	.....	.....	

*Trace amplitude.

SEISMOLOGICAL DISPATCHES.[1]

Alicante, Spain, September 10, 1919. (2 p. m.)

At 11:40 this morning, and with one second interval, two very intense earthquake shocks, of two seconds duration, were felt here. About fifteen minutes later two similar ones were felt. No damage reported as yet. (Special dispatch.)

Murcia, Spain, September 10, 1919. (6 p. m.)

During the last hours of the morning strong shocks began to be felt. At 1:30 p. m. the oscillations repeated but not as strongly. About 3 p. m. the earthquake was felt again, this time more violently. (Special dispatch.)

Alcony, Spain, September 10, 1919.

At 11:45 an oscillation was felt, which was repeated at 12 o'clock. It was of very short duration. (Special dispatch.)

Cartagena, Spain, September 10, 1919.

During this day several seismic movements were felt. They reached the number of five. The first was of three minutes duration. The last one was more intense than the others. (Special dispatch.)

Rome, Italy, September 12, 1919.

Several villages in the province of Siena were severely shaken last night by an earthquake. Houses collapsed or were badly damaged at Bagni, Asciana, Montorio, Radicofani, Pian Castagnajo, Badia, San Salvatore, and Celle. (Associated Press.)

Copenhagen, September 12, 1919. (*Belated.*)

A violent earthquake occured at Edinger, a town in Wurtenberg, Germany, Wednesday night, it was reported here today. (Associated Press.)

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

Honolulu, September 27, 1919.

Mauna Loa volcano on Hawaii Island, burst into eruption to-day at nearly the same spot as the eruption in 1916. (Associated Press.)

Fort De France, September 26, 1919.

A strong earthquake shock was felt here at 12:30 this afternoon. No damage reported. (Associated Press.)

TABLE 3.—*Late reports. (Instrumental.)*

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

District of Columbia. *Washington. Georgetown University.*

F. A. 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	0
	N	143	5.2	0
	Z	*80*	*5.0*	*0*

				H. m. s.	Sec.	μ	μ	Km	
Aug.	29	.....	eP_E	6 06 17	.....	.....	.....	.....	Heavy microseisms.
			eP_N	6 06 28	.....	.....	.....	.....	
			eL_E	6 25 00	17	.....	.....	.....	
			eL_N	6 26 12	17	.....	.....	.....	
			F	8 00 ..	.....	.....	.....	.....	
	31	.....	e_E	17 39 22	.....	.....	.....	.....	
			e_N	17 40 26	.....	.....	.....	.....	
			S_E	17 51 00	.....	.....	.....	.....	
			eL	18 05 24	11	.....	.....	.....	
			F	*19 10* ..	.....	.....	.....	.....	
				Vertical.					
	29	.....	*eP*	*6 06 28*	.....	.....	.....	.....	
			L	*6 53 06*	*13*	.....	.....	.....	
			F	*8 00* ..	.....	.....	.....	.....	

Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Frank Neumann.

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.

T_0 ″

Instrumental constant..13.1. Sensitiveness 0.40 arc tilt=1 mm.

				H. m. s.	Sec.	μ.	μ.	Km.	
Aug.	3	.....	L	18 43 ..	.....	.....	.....	.....	Beginning during daily routine.
			M	18 48 ..	18	*100	.....	.....	
			C	18 51 ..	.....	.....	.....	.....	
			F	*19 27* ..	.....	.....	.....	.....	
	18	.....	P	17 03 42	.....	.....	.....	.....	Maximum of all waves at 17h 10m 42s.
			iS	17 09 30	17	*1600	.....	.....	
			eL	17 16 00	.....	.....	.....	.....	
			M	17 32 00	.....	.....	.....	.....	
			C	17 37 ..	.....	.....	.....	.....	
			F	18 10 ..	18	.....	.....	.....	
	23	.....	L	16 36 ..	.....	.....	.....	.....	
			M	16 42 ..	.....	*100	.....	.....	
			F	16 45 ..	.....	.....	.....	.....	
	24	.....	L	5 28 18	.....	.....	.....	.....	
			M	5 34 00	15	*100	.....	.....	
			F	5 37 ..	.....	.....	.....	.....	
	27	.....	eP	5 29 42	17	.....	.....	.....	
			S	5 37 30	15	.....	.....	.....	
			L	5 48 00	.....	.....	.....	.....	
			M	5 55 12	18	*1900	.....	.....	
			C	6 01 ..	17	.....	.....	.....	
			F	6 55 ..	19	.....	.....	.....	
	28	.....	eL	20 16 ..	.....	.....	.....	.....	
			M	20 27 ..	19	*100	.....	.....	
			F	20 32 ..	.....	.....	.....	.....	
	29	.....	eP	6 00 00	.....	.....	.....	.....	P faint. Record not clear.
			S	6 05 30	17	.....	.....	.....	
			L	6 27 00	.....	.....	.....	.....	
			M	6 31 12	18	*5400	.....	.....	
			C	6 38 ..	16	.....	.....	.....	
			F	8 32 ..	18	.....	.....	.....	
	29	.....	eP	14 02 06	.....	.....	.....	.....	
			eS	14 08 00	.....	.....	.....	.....	
			eL	14 14 00	.....	.....	.....	.....	
			M	14 19 00	15	*200	.....	.....	
			C	14 21 ..	15	.....	.....	.....	
			F	14 45 ..	19	.....	.....	.....	
	31	.....	iP	17 29 24	19	.....	.....	.....	
			eL	17 40 00	.....	.....	.....	.....	
			M	17 43 00	18	*8800	.....	.....	
			C	17 58 ..	16	.....	.....	.....	
			F	20 25 ..	16	.....	.....	.....	

* Trace amplitude.

TABLE 3.—*Late reports (Instrumental).*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

New York. *Ithaca. Cornell University.* Heinrich Ries.

Lat., 42° 26′ 58″ N.; long., 76° 29′ 09″ W. Elevation, 242.6 meters.

Instruments: Two Bosch-Omori, 25 kg., horizontal pendulums (mechanical registration)

Instrumental constants..		V	T_0	ε
	E	13	22	4:1
	N	14	25	4:1

				H. m. s.	Sec.	μ.	μ.	Km.	
June	29	.....	eP_N	23 20 11	4	.....	.....	.....	
			eP_E	23 20 28	3	.....	.....	.....	
			iS_N	23 25 14	9	.....	.....	.....	
			e_E	23 27 28	7	.....	.....	.....	
			F_E	24 25 ..	.....	.....	.....	.....	
	30	.....	L_E	8 28 05	20	.....	.....	.....	
			F_E	8 36 ..	.....	.....	.....	.....	
Ju		.....	eP_N	7 11 12	3	.....	.....	.....	
			eS	7 16 25	7	.....	.....	.....	
			L_N	7 20 30	27	.....	.....	.....	
			F	7 40 ..	.....	.....	.....	.....	
	8	.....	L_N	21 59 30	18	.....	.....	.....	
			F_E	22 41 ..	.....	.....	.....	.....	
	9	.....	e_N	19 27 25	4	.....	.....	.....	
			eL_N	19 37 42	7	.....	.....	.....	
			F_N	20 02 ..	.....	.....	.....	.....	
	11	.....	e_N	0 39 30	3	.....	.....	.....	
			e_N	*0 42 32*	*5*	.....	.....	.....	
			e_N	0 42 48	5	.....	.....	.....	
			LL_N	0 45 22	8	.....	.....	.....	
			F_N	0 57 ..	.....	.....	.....	.....	
	17	.....	P_N	16 26 20	3	.....	.....	.....	
			eS_N	16 31 48	5	.....	.....	.....	
			eS_E	16 31 56	4	.....	.....	.....	
			eL_E	16 37 04	12	.....	.....	.....	
			eL_N	16 38 43	20	.....	.....	.....	
			F_N	16 56 ..	.....	.....	.....	.....	
	22	.....	P_E	22 07 56	2	.....	.....	.....	
			P_N	22 07 57	2	.....	.....	.....	
			S_E	22 12 53	5	.....	.....	.....	
			S_N	22 12 55	5	.....	.....	.....	
			L_E	22 15 05	5	.....	.....	.....	
			L_N	22 15 11	6	.....	.....	.....	
			F	22 24 ..	.....	.....	.....	.....	
Aug.	18	.....	eP_N?	17 15 36	4	.....	.....	.....	Microseisms.
		.....	S_E	17 21 15	5	.....	.....	.....	
		.....	S_N	17 21 18	8	.....	.....	.....	
		.....	L_N	17 24 11	9	.....	.....	.....	
		.....	*L_N*	*17 29 05*	*13*	.....	.....	.....	
		.....	F	17 43 ..	.....	.....	.....	.....	
	24	.....	L_E	6 02 ..	12	.....	.....	.....	
		.....	F	6 04 ..	.....	.....	.....	.....	
	29	.....	eP_N?	6 03 04	5	.....	.....	.....	Microseisms.
		.....	e_N	6 27 15	4	.....	.....	.....	
		.....	e_E	6 32 58	10	.....	.....	.....	
		.....	e_N	6 37 50	18	.....	.....	.....	
		.....	L_N	6 51 07	30	.....	.....	.....	
		.....	*L_N*	6 54 53	22	.....	.....	.....	
		.....	F	7 54 ..	.....	.....	.....	.....	
	30	.....	e_N	13 13 53	7	.....	.....	.....	May not be seismic.
		.....	L_N	13 22 56	9	.....	.....	.....	
		.....	F	13 33 ..	.....	.....	.....	.....	
	31	.....	eP_E	17 41 12	4	.....	.....	.....	
		.....	e_E	17 47 53	12	.....	.....	.....	
		.....	eS_E?	17 50 47	12	.....	.....	.....	
		.....	e_N	17 57 10	9	.....	.....	.....	
		.....	e_E	17 58 18	18	.....	.....	.....	
		.....	eL_E	18 07 15	20	.....	.....	.....	
		.....	*eL_N*	*18 12 10*	*36*	.....	.....	.....	
		.....	F	19 02 ..	.....	.....	.....	.....	

TABLE III.—*Late reports (instrumental)*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
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 & Hoye 80 kg. vertical seismograph.								
Instrumental constants. V 120 T_0 26								
			H. M. S.	*Sec.*	*μ*	*μ*	*Km.*	
Aug. 29	.....	i.....	6 06 47	.....	.....	.....	.....	Record of a distant earthquake. The first phases are lost in small micros.
	.....	e_N.....	6 12 33	.....	.....	.....	.....	
	.....	e.....	6 15 52	.....	.....	.....	.....	
	.....	e_N.....	6 23 50	.....	.....	.....	.....	
	.....	eL?...	6 46 ..	23	.....	.....	.....	
	.....	L.....	6 52 ..	30	.....	.....	.....	
	.....	L.....	7 05 ..	20	.....	.....	.....	
	.....	L.....	7 15 ..	18	.....	.....	.....	
	.....	L_E....	7 25 ..	17	.....	.....	.....	
	.....	L.....	7 40 ..	18	.....	.....	.....	
	.....	L_N....	7 45 ..	24	.....	.....	.....	
	.....	L_E....	7 45 ..	18	.....	.....	.....	
	.....	F.....	8 10 ..	.....	.....	.....	.....	
31	.....	e?.....	17 28 47	.....	.....	.....	8,540	N.-S. and E.-W. records very dissimilar. Very difficult to read.
	.....	eP_N?..	17 39 20	.....	.....	.....	.....	
	.....	iP_N....	17 40 38	.....	.....	.....	.....	
	.....	e_E.....	17 47 08	.....	.....	.....	.....	
	.....	eS_E?...	17 50 23	.....	.....	.....	.....	
	.....	e.....	17 48 33	.....	.....	.....	.....	
	.....	e.....	17 51 10	.....	.....	.....	.....	
	.....	eL_E?..	18 07 ..	.....	.....	.....	.....	
	.....	eL_E...	18 10 30	40	.....	.....	.....	
	.....	L.....	18 30 ..	18	.....	.....	.....	
	.....	L.....	18 40 ..	16	.....	.....	.....	
	.....	L.....	18 48 ..	16	.....	.....	.....	
	.....	L_E....	19 30 ..	16	.....	.....	.....	
	.....	F.....	20 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=0.45″.								
Aug. 13	.....	.....	.....	.....	.....	.....	.....	Minute microseisms from 0h to 7h. Impossible to detect movement recorded at other station from 0h 41m.
18	.....	iL.....	5 31 24?	.....	.....	.....	.....	Doubtful as to being seismic.
	.....	M.....	5 31 45	.....	*200	.....	.....	
	.....	F.....	5 35 00	.....	.....	.....	.....	
18	.....	L?.....	17 25 24	.....	.....	.....	.....	Early phases lost attending instrument.
	.....	L.....	17 31 30	.....	.....	.....	.....	
	.....	M?.....	17 33 42?	.....	*230	.....	.....	
	.....	eL.....	17 53 54	.....	.....	.....	.....	
24	.....	L.....	5 15 12	.....	*100	.....	.....	
	.....	F.....	5 18 48	.....	.....	.....	.....	
24	.....	iL?.....	5 29 18	.....	.....	.....	.....	
	.....	M.....	5 29 35	.....	*200	.....	.....	Last phase gradual thickening.
	.....	eL.....	5 35 48	.....	.....	.....	.....	
	.....	L.....	6 00 35?	.....	.....	.....	.....	
	.....	F.....	6 05 36	.....	.....	.....	.....	
24	.....	L.....	12 45 54	.....	.....	.....	.....	
	.....	L.....	12 58 54	.....	*50	.....	.....	

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
Canada. *Toronto. Dominion Meteorological Service*—Continued.								
Aug. 27	.....	L?.....	5 45 48	.....	.....	.....	.....	
	.....	L.....	5 59 48	.....	.....	.....	.....	
	.....	L.....	6 19 12	.....	.....	.....	.....	
	.....	eL.....	6 23 18	.....	.....	.....	.....	
	.....	M.....	6 34 30	.....	*300	.....	.....	
	.....	F.....	?	.....	.....	.....	.....	
29	.....	e?.....	5 58 42	.....	.....	.....	.....	Possibly 2 earthquakes. overlapping.
	.....	e.....	6 06 48	.....	.....	.....	.....	
	.....	L.....	6 16 18	.....	.....	.....	.....	Small micros make interpretation difficult.
	.....	L.....	6 34 54	.....	.....	.....	.....	
	.....	L.....	6 50 48	.....	.....	.....	.....	
	.....	i.....	6 54 36	.....	.....	.....	.....	
	.....	L.....	6 55 24	.....	.....	.....	.....	
	.....	eL.....	6 57 00	.....	.....	.....	.....	
	.....	M.....	7 09 30	.....	*2,300	.....	.....	
29	.....	.....	14 34 33	.....	.....	.....	.....	Micros while quake was recorded at other station.
29	.....	L.....	14 36 12	.....	*100	.....	.....	Micros going on.
31	.....	L.....	0 39 24	.....	*100	.....	.....	Do.
31	.....	i?.....	17 51 36	.....	.....	.....	.....	
	.....	eL.....	18 20 24	.....	.....	.....	.....	
	.....	eL.....	18 21 30	.....	.....	.....	.....	
	.....	eL.....	18 25 42	.....	.....	.....	.....	
	.....	M.....	18 29 12	.....	*2,400	.....	.....	
	.....	F.....	.....	.....	.....	.....	.....	Do.

* Trace amplitude.

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

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

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

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

Aug. 13	.....	L.....	0 41 00	.....	.....	.....	.....	
	.....	F.....	0 45 12	.....	*50	.....	.....	Minute thickening.
18	.....	M.....	17 17 06	.....	*300	.....	.....	
	.....	F.....	18 07 46	.....	.....	.....	.....	
24	.....	M.....	5 16 30	.....	*300	.....	.....	
	.....	F.....	5 47 30	.....	.....	.....	.....	
24	.....	M.....	12 43 40	.....	*100	.....	.....	
	.....	F.....	12 49 00	.....	.....	.....	.....	
27	.....	P.....	5 42 19	.....	.....	.....	.....	
	.....	S..	5 46 45	.....	.....	.....	.....	
	.....	L.....	?	.....	.....	.....	.....	
	.....	M.....	6 08 24	.....	*900	.....	.....	
	.....	F.....	6 56 05	.....	.....	.....	.....	
29	.....	P.....	6 02 03	.....	.....	.....	.....	Phases well defined.
	.....	S?.....	6 08 27	.....	.....	.....	.....	
	.....	L.....	6 12 00	.....	.....	.....	.....	
	.....	M.....	6 12 23	.....	*700	.....	.....	
	.....	L.....	6 18 54	.....	.....	.....	.....	
	.....	F.....	?	.....	.....	.....	.....	
29	.....	L.....	6 34 30	.....	.....	.....	.....	Do.
	.....	M.....	6 42 22	.....	*1,500	.....	.....	
	.....	F.....	8 30 34	.....	.....	.....	.....	
29	.....	P.....	14 34 33	.....	.....	.....	.....	
	.....	M.....	14 40 27	.....	*50	.....	.....	
	.....	F.....	14 46 21	.....	.....	.....	.....	
31	.....	P.....	0 29 12	.....	.....	.....	.....	
	.....	L.....	0 34 33	.....	.....	.....	.....	
	.....	M.....	0 37 32	.....	*50	.....	.....	
	.....	F.....	0 45 25	.....	.....	.....	.....	

* Trace amplitude.

SEISMOLOGY.

W. J. HUMPHREYS, Professor in Charge.

[Dated: Weather Bureau, Washington, D. C., Dec. 3, 1919.]

TABLE I.—*Noninstrumental earthquake reports, October, 1919.*

Day.	Approximate time, Greenwich civil.	Station.	Approximate latitude.	Approximate longitude.	Intensity Rossi-Forel.	Number of shocks.	Duration.	Sounds.	Remarks.	Observer.
		CALIFORNIA.	° ′	° ′						
1919.	*H. m.*						*Sec.*			
Oct. 1	18 42	Calexico	32 41	115 30	4	1	5	None	Felt by many	H. M. Rouse.
	21 46	do	32 41	115 30	3	1	2	Faint rumbling	Rapid vertical motion. Felt by many.	Do.
	23 50	do	32 41	115 30	5	1	1	do	Felt by many	Do.
2	7 31	do	32 41	115 30	5	1	70	do	do	Do.
4	6 15	do	32 41	115 30	3	1	8	Loud rumbling	do	Do.
	15 57	do	32 41	115 30	3	1	4	Faint rumbling	Felt by several	Do.
5	2 36	Eureka	40 45	124 15	3	1	2	None	do	L. B. Cooper.
13	20 35	Salinas	36 36	121 40	3	1	.....	do	do	E. D. Eddy.
25	22 40	do	36 36	121 40	3	1	.....	do	do	Do.
31	0 36	Lucerne Valley	34 27	116 57	3	1	.....	do	do	J. M. Henry.

TABLE 2.—*Instrumental seismological reports, October, 1919.*

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

[For significance of symbols see REVIEW for January, 1919, p. 59.]

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*Km.*	

Alabama. *Mobile. Spring Hill College.* Earthquake Station. Cyril Ruhlmann, S. J.

Lat., 30° 41′ 44″ N.; long., 88° 08′ 46″ W. Elevation, 60 meters.

Instrument: Wiechert 80 kg.; astatic, horizontal pendulum.

(No earthquake recorded during October, 1919.)

Alaska. *Sitka. Magnetic Observatory.* U. S. Coast and Geodetic Survey. F. P. Ulrich.

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

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

		V	T_0
Instrumental constants..	E	10	17
	N	10	15

(No earthquake recorded during October, 1919.)

Arizona. *Tucson. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Wm. H. Cullum.

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

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

		V	T_0
	E	10	15
	N	10	18

1919.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Oct. 1	.....	P_E	18 43 15	.....	.....	.....	.....	N not in operation during October.
		M_E	18 44 13	2	5	.....	.....	
		F_E	18 45 ..	.....	.....	.....	.....	
1	.....	iP_E	19 32 16	2	.....	.....	.....	
		L_E	19 33 12	.....	.....	.....	.....	
		M_E	19 33 55	.....	230	.....	.....	
		C_E	19 35 ..	.....	.....	.....	.....	
		F_E	19 45 ..	5	.....	.....	.....	
1	.....	eP_E	21 48 40	.....	.....	.....	.....	
		M_E	21 49 07	3	10	.....	.....	
		F_E	21 53 ..	.....	.....	.....	.....	
10	.....	eP_E	2 11 09	.....	.....	.....	.....	P indefinite.
		L_E	2 17 30	.....	.....	.....	.....	
		M_E	2 17 38	.....	20	.....	.....	
		F_E	2 27 ..	.....	.....	.....	.....	

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.

1919.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Oct. 5	.....	.....	.....	.....	100	200	.....	Tremors during 24 hours preceding 15 h.
7	.....	.....	.....	.....	200	200	.....	Tremors during 24 hours preceding 15 h.
8	.....	.....	.....	.....	100	200	.....	Tremors during 24 hours preceding 15 h.

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.

1919.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Oct. 1	Ii.....	L_E	19 36 30	.....	.....	.....	.....	P. not discernible. Distinct wavelets at intervals during day.
		L_N	19 36 30	.....	.....	.....	.....	
		M_E	19 37 ..	6	*2,000	.....	.....	
		M_N	19 37 ..	6	.....	*2,800	.....	
		F_E	19 38 ..	.....	.....	.....	.....	
		F_N	19 38 ..	.....	.....	.....	.....	
10	Ie.....	L_E	1 15 ..	12	.....	.....	.....	Regular sinusoidal. P. and M. not discernible. Wavelets very clear at intervals during day.
		L_N	1 15 ..	?	.....	.....	.....	
		F_E	1 35 ..	.....	.....	.....	.....	
		F_N	1 35 ..	.....	.....	.....	.....	
12–13	.....	.....	.....	.....	.....	.....	.....	Distinct activity at intervals during day.
15–16	.....	.....	.....	.....	.....	.....	.....	Wavelets visible at intervals during day.
20–21	.....	.....	.....	.....	.....	.....	.....	Thickening of penmarks at intervals during day. Doubtful as to being seismic.

*Trace amplitude.

TABLE 2.—*Instrumental seismological reports, October, 1919*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

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.. $V = 110$, $T_0 = 6.4$

1919. Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	*μ.*	*μ.*	*Km.*	
Oct. 1	.....	e.....	19 48 12	.....	.....	.....	.....	Heavy micros.
		L.....	19 49 12	.....	.....	.....	.....	
		F.....	20 *ca*	.....	.....	.....	.....	Lost in micros.
3	.....	e.....	10 30 00	.....	.....	.....	.....	
		L.....	10 32 30	20	.....	.....	.....	
		F.....	10 50 *ca*	.....	.....	.....	.....	Heavy micros.
10	.....	.....	.....	.....	.....	.....	.....	Earthquake between 1 h. and 2 h. *ca.*; small disturbances lasting nearly an hour. Clock not working.
12	.....	iP.....	.....	.....	.....	.....	.....	Earthquake shortly after 22 h. L *waves about one hour later.* Whole disturbance lasting about 1 h. 20 m. Clock not working.
14	.....	.....	.....	.....	.....	.....	.....	Earthquake between 17 h. and 18 h., lasting a half hour *ca.* Clock not working.
27	.....	P.....	3 52 30?	.....	.....	.....	.....	Time uncertain.
		S.....	4 00 00?	.....	.....	.....	.....	
		eL.....	4 10 *ca*	.....	.....	.....	.....	
		F.....	4 20 *ca*	.....	.....	.....	.....	
28	.....	P.....	7 29 15?	.....	.....	.....	.....	Time uncertain.
		S.....	7 33 45?	.....	.....	.....	.....	
		F.....	7 50 *ca*	.....	.....	.....	.....	

District of Columbia. *Washington. Georgetown University.*

F. A. 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 pendulum, 80 kg. vertical.

Instrumental constants.. {E: $V = 165$, $T_0 = 5.4$, $\epsilon = 0$; N: 143, 5.2, 0; Z: 90, 3.0, 0}

1919. Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	*μ.*	*μ.*	*Km.*	
Oct. 1[1]	.....	e_E.....	19 48 23	.....	.....	.....	.....	Very heavy micros.
		e_N.....	19 48 00	.....	.....	.....	.....	
		F.....	20 10 ..	.....	.....	.....	.....	
3	.....	e_E.....	10 07 33	.....	.....	.....	.....	Heavy micros.
		eL_N.....	10 30 24	11	.....	.....	.....	
		L_E.....	10 34 10	21	.....	.....	.....	
		F.....	11 *ca*	.....	.....	.....	.....	
10	.....	eP_E.....	1 14 18	.....	.....	.....	.....	Heavy micros
		eP_N.....	1 14 18	.....	.....	.....	.....	
		L_E.....	1 28 28	14	.....	.....	.....	
		L_N.....	1 28 28	14	.....	.....	.....	
		F.....	2 15 ..	.....	.....	.....	.....	
			VERTICAL.					
10	.....	eP_Z.....	1 14 23	.....	.....	.....	.....	
		L_Z.....	1 30 32	14	.....	.....	.....	
		F_Z.....	2 10 ..	.....	.....	.....	.....	
12	.....	eP_E.....	22 08 14	.....	.....	.....	.....	Very heavy micros.
		iP_N.....	22 08 14	.....	.....	.....	.....	
		S_N?.....	22 11 34	.....	.....	.....	.....	F impossible.

[1] Because of repairs going on in cave, seismograms for the month are difficult to evaluate.

Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Frank Neumann.

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

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

T_0

Instrumental constant 18.4. Sensitivity, 0.40″.

(Report for October, 1919, not received.)

Illinois. *Chicago.* University of Chicago. U. S. Weather Bureau.

Lat., 41° 47′ N.; long., 87° 37′ W. Elevation 189.1 meters.

Instruments: Two Milne-Shaw horizontal pendulums, 0.45 kg.

Instrumental constants..	V	T_0	ϵ	Sensitivity.
E.	150	12	20:1	1″ arc tilt=26.6 mm.
N.	150	8	20:1	1″ arc tilt=13.2 mm.

1919. Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	*μ.*	*μ.*	*Km.*	
Oct. 1	.....	e.....	19 44 7	.....	.....	.....	.....	Heavy micros.
		M.....	19 45 00	.....	.....	11	.....	
		F.....	19 55 *ca*	.....	.....	.....	.....	Lost in micros.
3	.....	P.....	10 02 8	.....	.....	.....	.....	
		PR_1.....	10 04 38	.....	.....	.....	.....	
		S.....	10 10 6	.....	.....	.....	.....	
		L.....	10 25 00	.....	.....	.....	.....	
		L.....	10 30 00	15	.....	.....	.....	
		F.....	12 20 *ca*	.....	.....	.....	.....	Heavy micros.
5	.....	e.....	2 54 00	.....	.....	.....	.....	
		L.....	2 55 30	15	.....	.....	.....	
		F.....	3 07 *ca*	.....	.....	.....	.....	Micros.
8	.....	P?.....	5 09 48	.....	.....	.....	.....	
		L.....	5 37 00	30	.....	.....	.....	
		L.....	5 42 00	22	.....	.....	.....	
		L.....	5 53 00	18	.....	.....	.....	
		F.....	7 10 *ca*	.....	.....	.....	.....	Micros.
8	.....	P?.....	22 49 55	.....	.....	.....	.....	
		S?.....	22 53 25	.....	.....	.....	.....	
		L.....	22 56 10	22	.....	.....	.....	
		F.....	23 15 *ca*	.....	.....	.....	.....	Heavy micros.
10	.....	P.....	1 12 40	.....	.....	.....	3,070	
		S.....	1 17 38	.....	.....	.....	.....	
		L.....	1 23 45	15	.....	.....	.....	
		F.....	3 30 *ca*	.....	.....	.....	.....	Heavy micros.
12	.....	iP.....	22 11 5	.....	.....	.....	.....	
		S?.....	22 20 25	.....	.....	.....	.....	
		L.....	22 54 00	40	.....	.....	.....	
		L.....	23 00 00	25	.....	.....	.....	
		L.....	23 15 00	22	.....	.....	.....	
		L.....	23 36 00	18	.....	.....	.....	
		L.....	23 52 00	15	.....	.....	.....	
13	.....	F.....	0 30 *ca*	.....	.....	.....	.....	
14	.....	P.....	12 03 23	.....	.....	.....	.....	
		L.....	12 10 00	18	.....	.....	.....	
		L.....	12 20 00	15	.....	.....	.....	
		F.....	12 50 *ca*	.....	.....	.....	.....	
14	.....	P.....	17 02 8	.....	.....	.....	.....	
		S?.....	17 05 12	.....	.....	.....	.....	
		L.....	17 07 00	.....	.....	.....	.....	
		F.....	18 *ca*	.....	.....	.....	.....	
21	.....	eL.....	22 21 00	.....	.....	.....	.....	
		L.....	22 27 00	18	.....	.....	.....	
		F.....	23 *ca*	.....	.....	.....	.....	
27	.....	P.....	3 50 37	.....	.....	.....	6,200	
		S.....	3 58 22	.....	.....	.....	.....	
		L.....	4 07 00	.....	.....	.....	.....	
		F.....	5 *ca*	.....	.....	.....	.....	
28	.....	.....	7 35 to 8 10 ..	.....	.....	.....	.....	Disturbances mixed with extremely heavy micros.

TABLE 2.—*Instrumental seismological reports, October, 1919.*—Continued.

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: Weichert.

		V	T_0	e
Instrumental constants..	E	177	3.4	4:1
	N	205	3.4	4:1

(Report for October, 1919, not received.)

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.

		V	T_0
Instrumental constants..	E	10	14
	N	10	14

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. M. S.	*Sec.*	*μ*	*μ*	*Km.*	
1919. Oct. 10	.....	eP_E	1 16 00	.....	.....	.....	.....	Phases indefinite. P very faint.
		eP_N	1 19 45	.....	.....	.....	.....	
		L_E	1 28 50	.....	.....	.....	.....	
		L_N	1 28 10	.....	.....	.....	.....	
		M_E	1 33 50	8	20	.....	.....	
		M_N	1 29 10	14	.....	20	.....	
		C_E	1 35 ..	8	.....	.....	.....	
		C_N	1 32 ..	10	.....	.....	.....	
		F_E	2 04 ..	8	.....	.....	.....	
		F_N	2 13 ..	9	.....	.....	.....	
			..					
14	.....	P_E	17 01 58	.....	.....	.....	.....	
		P_N	17 02 01	.....	.....	.....	.....	
		L_E	17 07 01	.....	.....	.....	.....	
		L_N	17 07 10	.....	.....	.....	.....	
		M_E	17 17 25	8	10	.....	.....	
		M_N	17 09 10	12	.....	10	.....	
		F.....	17 22 ...	8	.....	.....	.....	

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

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

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

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

(Report for October, 1919, not received.)

Missouri. *Saint 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.

	V	T_0	e
Instrumental constants..	80	7	5:1

(Report for October, 1919, not received.)

New York *Ithaca. Cornell University.* Heinrich Ries.

Lat., 42° 26′ 58″ N.; long., 76° 29′ 09″ W. Elevation, 242.6 meters.

Instruments: Two Bosch-Omori 25 kg. horizontal pendulums (mechanical registration.)

		V	T_0	e
Instrumental constants..	E	13	22	4:1
	N	14	25	4:1

(Report for October, 1919, not received.)

New York. *New York. Fordham University.* D. H. Sullivan, S. J.

Lat., 40° 51′ 47″ N.; long., 73° 53′ 08″ W. Elevation, 23.9 meters.

Instrument: Wiechert, 80 kg.

		V	T_0	e
Instrumental constants..	E	72	5.0	0
	N	72	5.0	0

(Report for October, 1919, not received.)

Panama, Canal Zone. *Balboa Heights.* Governor, Panama Canal.

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

Instruments: Two Bosch-Omori, 100 kg.

	V	T_0
Instrumental constants..	35	20

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. M. S.	*Sec.*	*μ.*	*μ.*		
1919. Oct. 9	.....	P_E	9 00 34	.....	.....	.....	183	Probably S. W.
		P_N	9 00 28	.....	.....	.....	.....	
		L_E	9 00 54	.....	.....	.....	.....	
		L_N	9 00 48	.....	.....	.....	.....	
		M_E	9 00 59	.....	*3,500	.....	.....	
		M_N	9 00 54	.....	.....	*3,000	.....	
		F_E	9 03 44	.....	.....	.....	.....	
		F_N	9 03 32	.....	.....	.....	.....	
27	.....	P_N	3 45 48	.....	.....	.....	2,776 cm	Record not clearly defined on the E. W. component.
		S_N	3 50 25	.....	.....	.....	.....	
		L_N	3 54 48	.....	.....	.....	.....	
		M_N	3 50 40	.....	.....	600	.....	
		F_N	4 17 00	.....	.....	.....	.....	

*Trace amplitude.

Porto Rico. *Viegues. Magnetic Observatory.* U. S. Coast and Geodetic Survey. W. M. Hill.

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

Instruments: Two Bosch-Omori.

		V	T_0
Instrumental constants	E	10	17
	N	10	19

(Report for October, 1919, not received.)

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

Lat., 44° 10′ N.; long., 72° 41′ W. Elevation, 256 meters.

Instruments: Two Bosch-Omri, mechanical registration.

		V	T_0
Instrumental constants..	E	10	15
	N	10	16

(No earthquake recorded during October, 1919.)

TABLE 2.—*Instrumental seismological reports, October, 1919*—Continued

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

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 & Hoye 80 kg. vertical seismograph.

Instrumental constants. $\frac{V}{120}$ $\frac{T_0}{26}$

1919.			H. m. s.	Sec.	μ	μ	Km.	
Oct. 1	.....	i_N	19 49 11	.....	.....	.....	.....	Irregular waves mixed with heavy micros.
		F	19 54 ..	.....	.....	.....	.....	
3	.....	e_E	10 06 30	.....	.....	.....	.....	Heavy micros.
		i_E	10 12 40	.....	.....	.....	.....	
		iL_N	10 30 23	11	.....	.....	.....	
		eL_E	10 31 ..	24	.....	.....	.....	
		L_E	10 35 ..	21	.....	.....	.....	
		L	10 40 ..	15	.....	.....	.....	
		L_E	10 49 ..	13	.....	.....	.....	
		L_E	11 00 ..	13	.....	.....	.....	
		L_E	11 11 ..	12	.....	.....	.....	
		F	11 15 ..	.....	.....	.....	.....	
8	.....	eL_E	5 40 ..	.....	.....	.....	.....	Very faint traces of sinusoidal L waves. Heavy micros.
		F	5 55 ..	.....	.....	.....	.....	
10	.....	Q	1 10 07	.....	.....	.....	2,560	
		P_E	1 15 20	.....	.....	.....	.....	Heavy micros.
		S_E	1 19 30	.....	.....	.....	.....	
		eL	1 24 48	.....	.....	.....	.....	
		L	1 29 ..	12	.....	.....	.....	
		L_E	1 30 ..	.....	.....	.....	.....	Very irregular and small L waves after 1 h. 30 m.
		L_E	2 15 ..	.....	.....	.....	.....	
		F	2 20 ..	.....	.....	.....	.....	
12	.....	i_N	22 10 55	.....	.....	.....	.....	Heavy micros obscure all earlier phases.
		i_E	22 11 46	.....	.....	.....	.....	
		eL_E	22 55 ..	35	.....	.....	.....	
		L_E	23 05 ..	20	.....	.....	.....	
		F	23 40 ..	.....	.....	.....	.....	
14	.....	e	17 13 ..	.....	.....	.....	.....	Irregular small waves.
		F	17 25 ..	.....	.....	.....	.....	
21	.....	eL	22 25 ..	.....	.....	.....	.....	Very faint sinusoidal L waves, barely discernible.
		F	22 50 ..	.....	.....	.....	.....	
27	.....	O	3 40 47	.....	.....	.....	6,560	
		P_N	3 50 50	.....	.....	.....	.....	Heavy micros prevent very accurate readings of initial impulses.
		S	3 58 56	.....	.....	.....	.....	
		eL_E	4 08 ..	.....	.....	.....	.....	
		L_E	4 10 ..	.....	.....	.....	.....	
		F	4 25 ..	.....	.....	.....	.....	
28	.....	$e?_E$	7 36 24	.....	.....	.....	.....	Very faint record. Barely discernible.
		$eL?_E$	7 40 17	.....	.....	.....	.....	
		F	7 50 ..	.....	.....	.....	.....	

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..18. Pillar deviation, 1 mm. swing of boom=0.45″. T_0

1919.			H. m. s.	Sec.	μ	μ	Km.	
Oct. 1	.....	.....	.....	.....	.....	.....	.....	Micros on sheet when other station records quake.
3	.....	E	10?02 00	.....	.....	.....	.....	Times doubtful, watch under repairs.
		E	10 06 24	.....	.....	.....	.....	
		S?	10 12 36	.....	.....	.....	.....	
		L	10 19 36	.....	.....	.....	.....	
		L	10 23 06	.....	.....	.....	.....	
		L	10 32 12	.....	.....	.....	.....	
		eL	10 33 36	.....	.....	.....	.....	
		M	10 39 42	.....	*1,300	.....	.....	
		F	.....	.....	.....	.....	.....	

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

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

1919.			H. m. s.	Sec.	μ	μ	Km.	
Oct. 3	.....	L	11 51 48	.....	.....	.....	.....	
		eL	11 59 18	.....	.....	.....	.....	
		M	12?05 54	.....	*300	.....	.....	Marked thickening.
8	.....	i	5 30 42	.....	.....	.....	.....	Times very doubtful, no cut-off.
		eL	5 43 48	.....	.....	.....	.....	
		eL	5 52 00	.....	.....	.....	.....	
		M	5 58 36	.....	*300	.....	.....	
		L	6?27 36	.....	.....	.....	.....	
		L	6?55 06	.....	.....	.....	.....	
		F	6?58 00	.....	.....	.....	.....	
10	.....	eL	1 25 54	.....	.....	.....	.....	Times very doubtful.
		iL	1 27 54	.....	.....	.....	.....	
		M	1 28 00	.....	*1,300	.....	.....	
		F	2 12 00	.....	.....	.....	.....	
12	.....	L	23 10 18	.....	.....	.....	.....	Times doubtful.
		M	23 14 36	.....	*200?	.....	.....	
21	.....	E	22 25 48	.....	.....	.....	.....	
		eL	22 32 54	.....	.....	.....	.....	
		M	22 35 30	.....	*100	.....	.....	
		F	.....	.....	.....	.....	.....	
27	.....	i?	3?47 30	.....	.....	.....	.....	Isolated micros, render initial phases doubtful.
		P	3?51 06	.....	.....	.....	.....	
		S	3 59 18	.....	.....	.....	.....	
		eL	4 10 30	.....	.....	.....	.....	
		M	4 12 30	.....	*300	.....	6?080	
		F	4 30 30	.....	.....	.....	.....	
28	.....	L	7 41 42	.....	.....	.....	.....	
		L	7 48 18	.....	.....	.....	.....	
		M	7 49 12	.....	*200	.....	.....	
		F	7 54 42	.....	.....	.....	.....	

* Trace amplitude.

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

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

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

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

1919.			H. m. s.	Sec.	μ	μ	Km.	
Oct. 1	.....	P	19 40 25	.....	.....	.....	.....	
		M	19 42 33	.....	*200	.....	.....	
		F	19 47 28	.....	.....	.....	.....	
3	.....	P	10 00 29	.....	.....	.....	.....	
		S?	10?13 51	.....	.....	.....	.....	
		L	10 18 41	.....	.....	.....	.....	
		M	10 27 32	.....	*400	.....	.....	
		F	11 11 18	.....	.....	.....	.....	
8	.....	P?	5 04 53	.....	.....	.....	.....	
		L	5 23 34	.....	.....	.....	.....	
		M	5 35 22	.....	‡800	.....	.....	
		F	7 14 43	.....	.....	.....	.....	
10	.....	P	1 08 01	.....	.....	.....	.....	
		L	1 09 00	.....	.....	.....	.....	
		M	1 09 30	.....	*1,000	.....	450	
		F	2 54 14	.....	.....	.....	.....	
12	.....	L	23?09 48	.....	.....	.....	.....	
		M	23 11 16	.....	*200	.....	.....	
12	.....	M	23 51 06	.....	*200	.....	.....	
13	.....	F	00 14 43	.....	.....	.....	.....	
14	.....	M?	12 04 32	.....	*50	.....	.....	May not be seismic.
21	.....	L?	22 09 15	.....	.....	.....	.....	
		M	22 15 09	.....	*400	.....	.....	
		F	22 32 51	.....	.....	.....	.....	
27	.....	L	4 22 17	.....	.....	.....	.....	
		L	4 23 35	.....	.....	.....	.....	
		F	4 28 17	.....	*100	.....	.....	Small but marked.

* Trace amplitude.

SEISMOLOGY.

W. J. HUMPHREYS, Professor in Charge.

[Dated: Weather Bureau, Washington, D. C., Jan. 3, 1920.]

TABLE I.—*Noninstrumental earthquake reports, November, 1919.*

Day.	Approximate time, Greenwich civil.	Station.	Approximate latitude.	Approximate longitude.	Intensity Rossi-Forel.	Number of shocks.	Duration.	Sounds.	Remarks.	Observer.
	H. m.	ARKANSAS.	° ′	° ′			*Sec.*			
Nov. 3	20 40	Pocahontas	36 15	90 55	5	1	.....	Loud rumbling	Felt by many	Benedictine Sisters.
		CALIFORNIA.								
6	0 15	Redlands	34 04	117 12	4	1	.....	None	Felt by several	P. W. Moore.
	0 15	Riverside	33 58	117 21	4	1	.....	None	do	J. H. D. Cox.
25	11 03	Centerville	37 30	122 00	5	2	.....	Loud rumbling	Felt by many	M. L. Mowry.
	11 03	Livermore	37 40	121 45	4	1	.....	None	Felt by several	E. J. Still.
	11 03	Los Gatos	37 12	121 58	4	1	.....	None	Felt by many	F. H. McCullagh.
	11 03	Petaluma	38 15	122 38	5	1	.....	None	do	*Santa Rosa Press Dem'cd.*
	11 03	San Francisco	37 45	122 30	4	1	5	None	Many people awakened	U. S. Weather Bureau.
	11 03	San Jose	37 15	121 53	3	1	10	None	Felt by many	Maurice Connell.
	11 03	San Jose	37 15	121 53	3	1	.....	None	do	U. S. Weather Bureau.
	11 03	Spreckles	36 35	121 38	3	2	2?	None	do	M. A. Klein.
	11 03	Stanford University	37 27	122 09	3	1	Few	None	do	S. D. Townley.
	11 15	Salinas	36 36	121 40	4	1	20	None	do	E. D. Eddy.

CORRIGENDUM.

REVIEW, September, 1919:
Page 688. The first quake on the 27th of September in the Toronto report should be deleted; it belongs to the Victoria report.

TABLE 2.—*Instrumental seismological reports, November, 1919.*

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

[For significance of symbols see REVIEW for January, 1919, p. 59.]

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

Alabama. *Mobile. Spring Hill College.* Seismic Observatory. Cyril Ruhlman, S. J.

Lat., 30° 41′ 44″ N.; long., 88° 08′ 46″ W. Elevation, 60 meters.

Instrument: Wiechert 80 kg.; astatic, horizontal pendulum.

(No earthquake recorded during November, 1919.)

Alaska. *Sitka. Magnetic Observatory.* U. S. Coast and Geodetic Survey. F. P. Ulrich.

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

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

Instrumental constants..		V	T_0
	E	10	17
	N	10	15

(No earthquake recorded during November, 1919.)

Arizona. *Tucson. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Wm. H. Cullum.

Lat., 32° 14′ 43″ N.; long., 110° 50′ 06″ W. Elevation, 769.6 meters.

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

Instrumental constants..		V	T_0
	E	10	17
	N	10	18

1919.			H. m. s.	Sec.	μ	μ	Km.	
Nov. 14	.....	P_E	6 48 36	3	.....	.....	.....	N not in operation.
		M_E	6 49 20	.....	20	.....	.....	
		F_E	6 53 —	.....	.....	.....	.....	

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 November, 1919, 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.

(No earthquake recorded during November, 1919.)

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

District of Columbia. *Washington. Georgetown University.* F. A. 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 pendulum, 80 kg. vertical.

Instrumental constants..		V	T_0	ε
	E	165	5.4	0
	N	143	5.2	0
	Z	80	5.0	0

1919.			H. m. s.	Sec.	μ	μ	Km.	
Nov. 6	.....	P_E	7 19 29	.....	.....	.....	.....	Very heavy micros.
		P_N	7 19 34	.....	.....	.....	.....	
		S_E	7 25 36	.....	.....	.....	.....	
		S_N	7 25 25	.....	.....	.....	.....	
		F	7 50 —	.....	.....	.....	.....	
18	.....	e	4 21 44	.....	.....	.....	.....	
		F	5 00 —	.....	.....	.....	.....	
18	.....	L_E	22 37 38	22	.....	.....	.....	Very heavy micros.
		L_N	22 33 26	24	.....	.....	.....	
		F	23 ca.	.....	.....	.....	.....	
18	.....	*eL*$_E$	*22 40 36*	.....	.....	.....	.....	Micros.
		L$_E$	*22 44 04*	*16*	.....	.....	.....	
		F	*23 ca.*	.....	.....	.....	.....	
20	.....	e_E	14 41 00	.....	.....	.....	.....	Very heavy micros.
		e_N	14 41 31	.....	.....	.....	.....	
		eL_E?	15 14 36	.....	.....	.....	.....	
		L_E	15 17 00	20	.....	.....	.....	
		F	15 30 —	.....	.....	.....	.....	
20	.....	*e*$_E$	*14 41 48*	.....	.....	.....	.....	Very heavy micros.
		L$_E$	*15 14 59*	*16*	.....	.....	.....	
		F	*15 50* ..	.....	.....	.....	.....	
28	.....	e_E?	14 20 00	.....	.....	.....	.....	Very heavy micros; difficult.
		e_N?	14 23 00	.....	.....	.....	.....	
		L	14 27 50	15	.....	.....	.....	
		F	14 38 ..	.....	.....	.....	.....	

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	T_0
	110	6.4

1919.			H. m. s.	Sec.	μ	μ	Km.	
Nov. 6	.....	e	7 24 00	.....	.....	.....	.....	Heavy micros; phases indeterminable.
		F	7 40 ca.	.....	.....	.....	.....	
18	.....	e	4 21 00	.....	.....	.....	.....	Phases indeterminable.
		F	4 35 00	.....	.....	.....	.....	
18	.....	S?	22 16 16	.....	.....	.....	.....	
		L	22 28 45	28	.....	.....	.....	
		L	22 33 30	20	.....	.....	.....	
		L	22 40 ..	16	.....	.....	.....	
		F	23 ca. ..	.....	.....	.....	.....	
20	.....	eL	14 40 ..	.....	.....	.....	.....	
		L	15 15 ..	20	.....	.....	.....	
		L	15 18 ..	16	.....	.....	.....	
		F	15 45 ..	.....	.....	.....	.....	
28	.....	e	14 22 00	.....	.....	.....	.....	
		L	14 27 50	16	.....	.....	.....	
		F	14 35 ca.	.....	.....	.....	.....	

Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Frank Neumann.

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
	18.4.

Sensitivity, 0.40″.

(Report for November, 1919, not received.)

TABLE 2.—*Instrumental seismological reports, November, 1919*—Continued.

Illinois. *Chicago.* University of Chicago. U. S. Weather Bureau.

Lat., 41° 47′ N.; long., 87° 37′ W. Elevation, 180.1 meters.

Instruments: Two Milne-Shaw horizontal pendulums, 0.45 kg.

Instrumental constants...		V	T_0	ε	Sensitivity.
	E.	150	12	20:1	1″ arc tilt=26.6 mm.
	N.	150	8	20:1	1″ arc tilt=13.2 mm.

1919.			H. m. s.	Sec.	μ	μ	Km.	
Nov. 6	.....	P?.....	7 21 25	.....	.....	.....	.....	
		S.....	7 26 04	.....	.....	.....	.....	
		L.....	7 28 30	.....	.....	.....	.....	
		L.....	7 34 ..	20	.....	.....	.....	
		F.....	8 10 ca.	.....	.....	.....	.....	
14	.....	P.....	6 49 41	.....	.....	.....	.....	
		S?.....	6 56 38	.....	.....	.....	.....	
		F.....	7 20 ca.	.....	.....	.....	.....	Lost in micros.
18	.....	P.....	4 21 07	.....	.....	.....	.....	
		L.....	4 40 ..	18	.....	.....	.....	
		L.....	4 58 ..	15	.....	.....	.....	
		L.....	5 14 ..	15	.....	.....	.....	
		F.....	5 40 ca.	.....	.....	.....	.....	Lost in micros.
18	.....	S?.....	22 16 06	.....	.....	.....	.....	
		L.....	22 34 ..	22	.....	.....	.....	
		L.....	22 40 ..	18	.....	.....	.....	
		L.....	22 45 ..	15	.....	.....	.....	
		F.....	23 50 ca.	.....	.....	.....	.....	Lost in micros.
20	.....	P.....	14 30 30	.....	.....	.....	.....	
		S.....	14 40 05	.....	.....	.....	.....	
		L.....	14 46 50	.....	.....	.....	.....	
		L.....	15 07 ..	25	.....	.....	.....	
		L.....	15 11 ..	18	.....	.....	.....	
		L.....	15 20 ..	16	.....	.....	.....	
		F.....	17 ca...	.....	.....	.....	.....	Lost in heavy micros.
23	.....	L.....	6 56 ..	22	.....	.....	.....	Heavy micros; P. and S. not discernible.
		L.....	7	20	.....	.....	.....	
		L.....	8 05 ..	15	.....	.....	.....	
		F.....	8 30 ..	.....	.....	.....	.....	
28	.....	P.....	14 21 00	.....	.....	.....	.....	Micros.
		S.....	14 27 08	.....	.....	.....	.....	
		L.....	14 29 45	17	.....	.....	.....	
		F.....	16 ca...	.....	.....	.....	.....	

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: Weichert.

Instrumental constants..		V	T_0	ε
	E	177	3.4	4:1
	N	205	3.4	4:1

(Report for November, 1919, not received.)

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..		V	T_0
	E	10	14
	N	10	14

(No earthquake recorded during November, 1919.)

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.

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

Instrumental constants..		V	T_0	ε
	E	80	23	0
	N	50	25	4:1

(Report for November, 1919, not received.)

Missouri. *Saint 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	T_0	ε
	80	7	5:1

(Report for November, 1919, not received.)

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	T_0	ε
	80	7	5:1

(Report for November, 1919, not received.)

New York. *Ithaca. Cornell University.* Heinrich Ries.

Lat., 42° 26′ 58″ N.; long., 76° 29′ 09″ W. Elevation, 242.6 meters.

Instruments: Two Bosch-Omori 25 kg. horizontal pendulums (mechanical registration.)

Instrumental constants..		V	T_0	ε
	E	13	22	4:1
	N	14	25	4:1

1919.			H. m. s.	Sec.	μ	μ	km.	
Nov. 18	.....	e_m.....	22 13 50	10	.....	.....	.....	
		L_m.....	22 23 50	25	.....	.....	.....	
		F_m.....	23 10 ..	.....	.....	.....	.....	
20	.....	L_m.....	15 15 50	20	.....	.....	.....	Earlier phases lots in micros.
		F_m.....	15 33 ..	.....	.....	.....	.....	

New York. *New York. Fordham University.* D. H. Sullivan, S. J.

Lat., 40° 51′ 47″ N.; long., 73° 53′ 08″ W. Elevation, 23.9 meters.

Instrument: Wiechert 80 kg.

Instrumental constants..		V	T_0	ε
	E	72	5.0	0
	N	72	5.0	0

(Report for November, 1919, not received.)

Panama, Canal Zone. *Balboa Heights.* Governor, Panama Canal.

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

Instruments: Two Bosch-Omori, 100 kg. and 25 kg.

Instrumental constants..	V	T_0
	35	20
	10	20

(Report for November, 1919, not received.)

Porto Rico. *Viegues. Magnetic Observatory.* U. S Coast and Geodetic Survey. W. M. Hill.

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

Instruments: Two Bosch-Omori.

Instrumental constants..		V	T_0
	E	10	17
	N	10	19

(Report for November, 1919, not received.)

TABLE 2.—*Instrumental seismological reports, November, 1919*—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 10 16

(No earthquake recorded during November, 1919.)

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.
1919 Nov. 6	.....	L_E	H. m. s. 7 27	Sec.	μ	μ	Km.	N.-S. masked by micros.
		L_E	7 29	15	.....	.....	.....	
		L_E	7 33	15	.....	.....	.....	
		F	7 40	15	.....	.....	.....	
18	.....	i	4 21 27	.....	.....	.....	.....	L waves sinusoidal, but so small in amplitude as to be barely visible.
		L_E	4 38 to 5 15	.....	.....	.....	.....	
		F	5 25	.....	.....	.....	.....	
18	.....	iS?	22 15 23	.....	.....	.....	.....	Micros interfere with any preceding phases.
		eL	22 26 24	40	.....	.....	.....	
		L	22 30	25	.....	.....	.....	Sinusoidal L waves which are remarkable for the similarity on both components.
		L	22 39	16	.....	.....	.....	
		L_E	22 58	9	.....	.....	.....	
		F	23 10	.....	.....	.....	.....	
20	.....	e?$_E$	14 41 09	.....	.....	.....	.....	
		eL?	15 05	.....	.....	.....	.....	
		L	15 14	.....	.....	.....	.....	
		L_E	15 18 to 15 30	18	.....	.....	.....	
		F	15 36	.....	.....	.....	.....	
23	.....	L_E	6 58 to 7 11	24	.....	.....	.....	
		L_E	7 13 to 7 18	.....	.....	.....	.....	
		L_E	7 23	.....	.....	.....	.....	
		F	7 28	.....	.....	.....	.....	
28	.....	iS$_E$?	14 19 18	.....	.....	.....	.....	This quake, though smaller, bears a striking resemblance to the second quake on Nov. 18, above.
		iS?$_E$	14 19 24	.....	.....	.....	.....	
		eL	14 23 40	15	.....	.....	.....	
		L_E	14 28 to 14 32	13	.....	.....	.....	
		F	14 35	.....	.....	.....	.....	

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.[1]

Instrumental constant..T_0=18. Pillar deviation, 1 mm. swing of boom=0.45″.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919. Nov. 1	.....	eL	H. m. s. 5 58 06	Sec.	μ	μ	Km.	Gradual thickening.
		M	5 59 42	.....	*200	.....	.....	
		F	6 07 18	.....	.....	.....	.....	
6	.....	L	7 27 48	.....	.....	.....	.....	
		eL	7 39 06	.....	*100	.....	.....	
		F	7 45 06	.....	.....	.....	.....	
18	.....	L	4 31 18	.....	.....	.....	.....	
		L	4 45 00	.....	*50	.....	.....	
		L	4 46 18	.....	.....	.....	.....	

*Trace amplitude.

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

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919. Nov. 18	.....	e	H. m. s. 22 06 18	Sec.	μ	μ	Km.	P. waves not defined.
		e	22 12 30	.....	.....	.....	.....	
		S	22 14 48	.....	.....	.....	.....	
		L	22 24 30	.....	.....	.....	.....	
		L	22 35 00	.....	.....	.....	.....	
		L	22 39 36	.....	.....	.....	.....	
		eL	22 40 48	.....	.....	.....	.....	
		M	22 41 36	.....	*1,300	.....	.....	
		F	23 42 54	.....	.....	.....	.....	
20	.....	e	14?37 12	.....	.....	.....	.....	Small micros interfered with initial phases.
		L	14 41 18	.....	*100	.....	.....	
		L	14 58 12	.....	.....	.....	.....	
		L	15 15 00	.....	.....	.....	.....	
		eL	15 19 00	.....	.....	.....	.....	Marked thickening 15 19 to 15 26 12.
		M	15 24 12	.....	*800	.....	.....	
		F	16?03 00	.....	.....	.....	.....	
20	.....	L	16 28 54	.....	*50	.....	.....	
		F	17 09 48	.....	.....	.....	.....	
23	.....	e	7 03 30	.....	.....	.....	.....	
		eL	7 11 42	.....	.....	.....	.....	
		M	7 18 18	.....	*200	.....	.....	Gradual thickening.
		F	7 31 54	.....	.....	.....	.....	
28	.....	e	14 12 30	.....	.....	.....	.....	Asia Minor. Micros interfered with definition of waves.
		L	14 22 30	.....	.....	.....	.....	
		L	14 25 42	.....	.....	.....	.....	
		M	14 29 42	.....	.....	.....	.....	
		F	.....	.....	*100	.....	.....	Micros.

*Trace amplitude.

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

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

Instrument: 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.
1919. Nov. 6	.....	P?	H. m. s. 7 47 51	Sec.	μ	μ	Km.	
		M	7 51 47	.....	*300	.....	.....	
		F	8 03 36	.....	.....	.....	.....	
14	.....	P	6?57 06	.....	.....	.....	.....	
		L	6 58 35	.....	.....	.....	.....	
		M	7 02 32	.....	*300	.....	656?	
		F	7 16 18	.....	.....	.....	.....	
18	.....	P	4 23 04	.....	.....	.....	.....	
		S	4 31 26	.....	.....	.....	.....	
		L	4 45 41	.....	.....	.....	.....	
		M	4 54 47	.....	*500	.....	6,860	
		F	5 17 10	.....	.....	.....	.....	
18	.....	P?	22 29 32	.....	.....	.....	.....	
		S?	22 34 27	.....	.....	.....	.....	
		L	22 40 51	.....	.....	.....	.....	
		M	22 48 13	.....	*500	.....	3,170?	
		F	23 25 06	.....	.....	.....	.....	
20	.....	P	14 24 15	.....	.....	.....	.....	
		S	14 27 52	.....	.....	.....	.....	
		L?	14 34 05	.....	.....	.....	.....	
		M	14 37 32	.....	*400	.....	2,160	
		eL	14 56 52	.....	.....	.....	.....	
		F	15 25 14	.....	.....	.....	.....	
20	.....	M	16 43 56	.....	*200	.....	.....	
		F	17 00 40	.....	.....	.....	.....	
23	.....	P	6 23 31	.....	.....	.....	.....	
		S	6?30 24	.....	.....	.....	.....	
		L	6 38 16	.....	.....	.....	.....	
		M	6 46 38	.....	*400	.....	5,200?	
		F	7?09 45	.....	.....	.....	.....	
28	.....	P?	14 04 28	.....	.....	.....	.....	
		M	14 35 27	.....	*200	.....	.....	Asia Minor?

*Trace amplitude.

SEISMOLOGICAL DISPATCHES.

Guatemala City, Guatemala, October 14, 1919.

A severe earthquake was felt this day at Amatitlan, a town situated about 25 kilometers from this place. At Puerto Barrios its intensity was such as to cause general alarm. (Georgetown Cooperative Station.)

Florence, Italy, October 26, 1919.

Homes and schools were abandoned in a panic here when an earthquake rocked the city yesterday afternoon. The quake was a strong undulating movement of the ground, especially heavy in Avezzo and Valdarno, where heavy damage was reported. The tremor was also felt at San Repolero and throughout the valley of Arno and Chiana. (Associated Press.)

Quebec, Canada, October 27, 1919.

An earthquake shock was recorded on the north shore of the Gulf of St. Lawrence early Sunday morning. It started at 5.28 and the tremor was felt for two minutes. No damage reported. (Associated Press.)

Fort de France, Martinique, November 7, 1919.

Quite a strong earthquake shock was felt here at 3.15 this morning. No serious damage resulted. (Associated Press.)

Salta, Argentina, November 10, 1919.

A strong earthquake shock, lasting several seconds, was felt here shortly after last midnight. The tremors were repeated at 5 o'clock this morning with less intensity. No damage has been reported.

San Francisco, November 25, 1919.

Portions of San Francisco were shaken for half a minute early this morning by an earthquake. No damage was reported, though sleepers were jarred from their beds. The quake occurred at 3.04 o'clock. (United Press.)

Detroit, Mich., November 27, 1919.

That a meteor of tremendous size plunged into Lake Michigan last night, causing earth tremors felt in a dozen southern Michigan cities and sending a pillar of flame hundreds of feet into the air which was visible for a radius of more than 50 miles, was the theory generally accepted early to-day in explanation of the earth shock which at first was believed to have been caused by a terrific explosion at some industrial plant. (Associated Press.)

Paris, November 29, 1919.

A slight earthquake shock, lasting seven seconds, was felt at 20 minutes to 10 o'clock last night at Cannes, in the Riviera, it was announced in messages received here this morning. A heavier shock was experienced a half hour after midnight at Foix, 45 miles south of Toulouse, at the foot of the Pyrenees. Only slight damage was done at either place. (Associated Press.)

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

TABLE 3.—LATE REPORTS. (INSTRUMENTAL.)

New York. *Ithaca. Cornell University.* Heinrich Ries.

Lat., 42° 26′ 58″ N.; long., 76° 29′ 09″ W. Elevation, 242.6 meters.

Instruments: Two Bosch-Omori, 25 kg. horizontal pendulums (mechanical registration).

Instrumental constants.. V: E 13, N 14; T_0: E 22, N 25; ε: E 4:1, N 4:1

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*Km.*	
1919.								
Sept. 6	.....	P_N	9 35 44	4	.....	.....	.....	Clock out of order. Clock error uncertain throughout month.
		S_E	9 40 03	7	.....	.....	.....	
		S_N	9 40 07	6	.....	.....	.....	
		L_N	9 41 13	11	.....	.....	.....	
		L_E	9 41 17	11	.....	.....	.....	
		F_E	10 27 ..	.....	.....	.....	.....	
13	.....	e_N	12 30 15	4	.....	.....	.....	
		i_E	12 38 17	5	.....	.....	.....	
		i_N	12 38 18	5	.....	.....	.....	
		L_N	12 52 ..	20	.....	.....	.....	
		F_N	13 09 ..	.....	.....	.....	.....	
15	.....	I.....	17 49 15	5	.....	.....	.....	Phases lost in micros.
		F.....	18 05 ..	.....	.....	.....	.....	
27	.....	e_N	11 33 10	3	.....	.....	.....	e_N may be micros. Phases overlapping. Origin not far away.
		e_E	11 33 39	3	.....	.....	.....	
		F_N	11 39 ..	.....	.....	.....	.....	
30	.....	e_N	7 55 15	4	.....	.....	.....	
		e_E	7 55 52	11	.....	.....	.....	
		F.....	8 12 ..	.....	.....	.....	.....	
Oct. 3	.....	L_E	10 37 ..	18	.....	.....	.....	
		F_E	10 58 ..	.....	.....	.....	.....	
10	.....	L.....	1 27 06	18	.....	.....	.....	
		F.....	2 01 ..	.....	.....	.....	.....	
12	.....	e_N	22 11 12	4	.....	.....	.....	
		eL_N	23 13 15	24	.....	.....	.....	
		F.....	23 27 ..	.....	.....	.....	.....	
27	.....	P_N	3 50 30	4	.....	.....	.....	
		e_E	3 52 59	5	.....	.....	.....	
		eS.....	3 58 24	5	.....	.....	.....	
		L_E	4 08 18	16	.....	.....	.....	
		F_E	4 17 ..	.....	.....	.....	.....	

Porto Rico. *Vieques. Magnetic Observatory.* U. S. Coast and Geodetic Survey. W. M. Hill.

Lat., 19° 09′ N.; 65° 27′ W. Elevation, 19.8 meters.

Instruments: Two Bosch-Omori.

Instrumental constants.. V: E 10, N 10; T_0: E 17, N 19

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*Km.*	
1919.								
Oct. 14	.....	L_E	17 03 17	.....	.....	.....	.....	Nothing on N. Times obtained by interpolation over an interval of 12 hours.
		M_E	17 05 33	17	10	.....	.....	
		F_E	17 15 ..	.....	.....	.....	.....	

Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Frank Neumann.

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 18.4. Sensitiveness 0.40 arc tilt-1 mm.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	μ	μ	*Km.*	
1919.								
Oct. 3	.....	*IP.....	*9 51 18*	*17*	**3,300*	.....	.....	The actual maximum, 3,300, occurs at 9.56, and probably obscures the beginning of L.
		IS.....	9 54 30	.....	.....	.....	.....	
		eL.....	10 00 12	.....	.....	.....	.....	
		M.....	10 06 30	16	*1,100	.....	.....	
		C.....	10 22 ..	15	.....	.....	.....	
		F.....	11 36 ..	18	.....	.....	.....	
6	.....	L.....	2 04 36	.....	.....	.....	.....	
		M.....	2 08 12	.....	*100	.....	.....	
		F.....	2 19 ..	.....	.....	.....	.....	
8	.....	eP.....	4 50 18	18	.....	.....	.....	
		S.....	4 55 30	17	.....	.....	.....	
		eL.....	5 09 24	.....	.....	.....	.....	
		M.....	5 22 00	17	*500	.....	.....	
		C.....	5 29 ..	17	.....	.....	.....	
		F.....	6 30 ..	18	.....	.....	.....	
10	.....	L.....	1 18 18	.....	.....	.....	.....	
		M.....	1 27 00	16	*2,000	.....	.....	
		C.....	1 30 00	17	.....	.....	.....	
		F.....	2 40 ..	16	.....	.....	.....	
21	.....	P.....	21 39 18	21	.....	.....	.....	
		L.....	21 49 24	22	.....	.....	.....	
		M.....	21 59 30	16	*400	.....	.....	
		C.....	22 05 30	16	.....	.....	.....	
		F.....	22 50 ..	19	.....	.....	.....	
23	.....	P.....	0 43 24	.....	.....	.....	.....	
		M.....	0 44 24	.....	*400	.....	.....	
		C.....	0 46 ..	.....	.....	.....	.....	
		F.....	0 49 ..	.....	.....	.....	.....	
23	.....	eP.....	16 23 30	.....	.....	.....	.....	Hourly time breaks missing. Times obtained by interpolation over a period of 17 hours.
		eL.....	16 41 ..	.....	.....	.....	.....	
		M.....	16 49 00	15	*100	.....	.....	
		C.....	16 54 30	.....	.....	.....	.....	
		F.....	20 34 ..	.....	.....	.....	.....	
26	.....	L.....	19 29 ..	.....	.....	.....	.....	
		M.....	19 36 30	18	*100	.....	.....	
		C.....	19 42 ..	.....	.....	.....	.....	
		F.....	21 18 ..	.....	.....	.....	.....	
27	.....	P.....	4 04 54	.....	.....	.....	.....	
		M.....	4 07 12	20	*100	.....	.....	
		C.....	4 10 30	.....	.....	.....	.....	
		F.....	4 38 ..	.....	.....	.....	.....	
31	.....	eP.....	19 35 18	.....	.....	.....	.....	
		L.....	19 43 00	.....	.....	.....	.....	
		M.....	19 46 18	15	*100	.....	.....	
		C.....	20 02 ..	17	.....	.....	.....	
		F.....	20 10 ..	19	.....	.....	.....	

* Trace amplitude.

THE VIRGINIA EARTHQUAKE OF SEPTEMBER 5, 1919.

By EDGAR W. WOOLARD, Assist. Observer.

[Dated: Weather Bureau, Washington, D. C., Dec., 1919.]

Distinct earthquake shocks were felt over the Blue Ridge region of Warren and Rappahannock counties, Virginia, about 10 p. m. local standard "summer" time, September 5, 1919, or 2 h. Greenwich civil time, September 6. The shocks were apparently of greatest intensity in Harmony Hollow, a valley to the east of Dickeys Hill, between the latter and the crest of the main Blue Ridge and a few miles south of Front Royal, or near Arco. This same area was the one of highest intensity in the earthquake of April 9, 1918. A report, by Dr. T. L Watson, of the Virginia Geological Survey, on the geology of this region as related to the two disturbances will appear in the *Bulletin* of the Seismological Society of America.

The quake appears to have been entirely local. It was distinctly registered at Washington, D. C., on the seismographs of the U. S. Weather Bureau and Georgetown University, as a very small brief disturbance; it was not noticeable to the senses, however, more than 40 miles from Front Royal. Inquiries directed to Winchester, Strasburg, Woodstock, Mount Weather, Rectortown, and Waterlick failed to locate anyone who had felt the shocks.

There was a gradual onset of trembling shocks, intensity 4 (adapted Rossi-Forel), one mile north of Front Royal, there being two shocks, each lasting about three minutes, accompanied by a rumbling sound; many people felt these. The disturbance was felt, intensity 4, at Riverton, and by many people at Limeton; also, one-half mile southeast of Reager. Trembling shocks, intensity 3, lasting three minutes, were felt by many people in and near Cedarville, but no damage was done. At Arco, rocking shocks, intensity 8, with loud rumbling sound were reported by J. A. Silman, who states that "this earthquake caused a good bit of excitement; some never-failing springs are dry since, and the rocks fell from chimneys, this occurring about one-half mile north of Arco; springs around in the neighborhood of 2 miles were muddy next day; there have been slight quakes since, but I haven't the exact date." Chas. M'Clure was writing in his office in Front Royal "when there was a sudden heavy jar, and a sound as if something had fallen in some part of the building." Near Arco he found that "considerable excitement ensued from repeated severe shocks accompanied on the first shock by an explosive sound as if of a heavy blast, and on the second shock about an hour later, a still heavier explosion of the same character. Several subsequent shocks are reported." Plaster fell from walls, and glassware from shelves. Children were panic-stricken, and one was thrown into convulsions. A widespread phenomenon was that of many clear streams suddenly becoming, and remaining, turbid, although there had been no rain.

○

SEISMOLOGY.

W. J. HUMPHREYS, Professor in Charge.

[Dated: Weather Bureau, Washington, D. C., Feb. 3, 1920.]

TABLE I.—*Noninstrumental earthquake reports, December, 1919.*

Day.	Approximate time, Greenwich civil.	Station.	Approximate latitude.	Approximate longitude.	Intensity Rossi-Forel.	Number of shocks.	Duration.	Sounds.	Remarks.	Observer.
		CALIFORNIA.								
1919.	*H. m.*		° ′	° ′			*Sec.*			
Dec. 5	10 34	San Francisco	37 48	122 26	4	1		None	Felt by many	U. S. Weather Bureau.
11	23 29	Santa Cruz	36 55	122 00	5	1		do	Felt by several	W. R. Springer.
		Los Gatos	37 12	121 58	4	1		do	do	F. H. McCullagh.
12	5 38	Aguanga	33 30	117 00	2	1	2	do	Short and sharp	A. J. Berg.
18	7 15	Paso Robles	35 40	120 45	3	1		do	Felt by several	Mrs. A. Z. Campbell.
20	9 30	Santa Rosa	38 30	122 45	4	1		do	do	Press report.
		OREGON.								
26	6 00	Bullrun	45 30	122 12	4			None	Men awakened; shocks throughout night.	

CORRIGENDUM.

REVIEW, August, 1919, page 601:
In the record of the quake on August 18, it should have been reported from 17 to 18 hours *ca.* instead of from 5 to 6 hours.

TABLE 2.—*Instrumental seismological reports, December, 1919.*

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

[For significance of symbols see REVIEW for January, 1919, p. 59.]

Alabama. *Mobile. Spring Hill College.* Seismic Observatory. Cyril Ruhlman, S. J.

Lat., 30° 41′ 44″ N.; long., 88° 08′ 46″ W. Elevation, 60 meters.

Instrument: Wiechert 80 kg.; astatic, horizontal pendulum.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Dec. 5	.....	iP?	0 19 22	.....	.....	.....	.....	
		S?	0 20 32	12	.....	*4,000	.....	N component undamped.
		L?	0 22 46	6	.....	*3,500	.....	E only a trace.
		F	0 46 00	.....	.....	.....	.....	

* Trace amplitude.

Alaska. *Sitka. Magnetic Observatory.* U. S. Coast and Geodetic Survey. F. P. Ulrich.

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

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

Instrumental constants.. $\begin{cases} E & V\ 10 & T_0\ 18 \\ N & 10 & 16 \end{cases}$

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Dec. 15	.....	ePE	1 10 24	.....	.....	.....	.....	Felt at Juneau.
		eP_N	1 10 23	.....	.....	.....	.....	
		M_E	1 11 02	5	10	10	.....	
		F_E	1 12 23	.....	.....	.....	.....	
		F_N	1 11 31	.....	.....	.....	.....	

Arizona. *Tucson. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Wm. H. Cullum.

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

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

Instrumental constants.. $\begin{cases} E & V\ 10 & T_0\ 17 \\ N & 10 & 18 \end{cases}$

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1919.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Dec. 18	.....	ePE	1 24 43	.....	.....	.....	.....	
		eP_N	1 24 40	3	.....	.....	.....	
		L_E	1 29 13	.....	.....	.....	.....	
		L_N	1 29 09	.....	.....	.....	.....	
		M_E	1 29 44	.....	20	.....	.....	
		M_N	1 29 40	4	.....	30	.....	
		C_E	1 33	5	.....	.....	.....	
		C_N	1 21	.....	.....	.....	.....	
		F_E	1 38	.....	.....	.....	.....	
		F_N	1 33	.....	.....	.....	.....	

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

California. *Mount Hamilton. Lick Observatory.*
(*See* Bulletin of the Seismographic Stations, University of California.)

California. *Point Loma. Raja Yoga Academy.* F. J. Dick.
(Report for December, 1919, not received.)

TABLE 2.—*Instrumental seismological reports, December, 1919.*—Continued.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

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

(*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.

1919.			H. m. s.	Sec.	μ	μ	Km.	
Dec. 2		L_E	14 44 ..					Very distinct sinusoidal on E-W. Recurs during day.
		F_E	17 30 ..					
12		L_E	14 20 ..					Distinct but irregular wavelets at intervals.
		F_E	16 50 ..					
18		P_E	1 29 ..					Second P. not discernible.
		M_E	1 31 ..	4	*2,500			
		C_E	1 35 ..					
		F_E	1 38 ..					
22		L_E	2 08 ..					Very small but distinct sinusoidal recurring at intervals.
		F_E	3 50 ..					
23								Activity at intervals during day.
24								Do

* Trace amplitude.

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.

	V	T_0
Instrumental constants..	110	6.4

1919.			H. m. s.	Sec.	μ	μ	Km.	
Dec. 5		P	0 21 25				3,030	
		S	0 26 05					
		F	0 45 *ca.*					
20		eL	21 35 ..	30				
		L	21 45 ..	20				
		L	21 50 ..	16				
		F	22 20 *ca.*					

District of Columbia. *Washington. Georgetown University.* F. A. 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 pendulum, 80 kg. vertical.

		V	T_0	e
Instrumental constants..	E	165	5.4	0
	N	143	5.2	0
	Z	*80*	*3.0*	*0*

1919.			H. m. s.	Sec.	μ	μ	Km.	
Dec. 5		eP	0 21 23					
		eS	0 26 00					
		eL	0 28 48					
		F	0 49 ..					
14		L	2 15 to 2 34	9				Very heavy micros.
		F	2 42 ..					
18		e	1 26 37					Do.
		Sm?	1 32 00					
		F	1 50 ..					
20		eL	21 35 00					
		L	21 41 16	16				
		F	22 14 ..					

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Frank Neumann.

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.

	T_0
Instrumental constant..	18.4. Sensitivity, 0.40″.

1919.			H. m. s.	Sec.	μ	μ	Km.	
Dec. 11		P	23 29 54	20				
		eL	23 31 30					
		M	23 33 06	18	*700			
		C	23 36 36					
		F	24 15 ..					
12		P	4 00 48	14				Phases not consistent.
		S?	4 04 24	20				
		eL	4 09 54					
		M	4 16 06	18	*100			
		C	4 18 ..					
		F	4 23 ..					
14		P	1 26 18	17				
		S	1 33 48	17				
		eL	1 38 30					
		M	1 51 06	15	*300			
		C	1 54 ..					
		F	2 31 ..					
17		P	23 55 54					
		L	24 00 00					
18		M	24 04 24	10	*300			
		C	24 08 ..	20				
		F	24 34 ..					
20		eP	20 01 12	19				P confused by air tremors.
		L	20 16 54					
		M	20 23 30	15	*300			
		C	20 34 ..	20				
20		eP	20 58 48	17				P confused by end of previous quake.
		L	21 22 30					
		M	21 27 30	15	*1,000			
		C	21 36 ..	18				
		F	23 26 ..					

* Trace amplitude.

Illinois. *Chicago.* University of Chicago. U. S. Weather Bureau.

Lat., 41° 47′ N.; long., 87° 37′ W. Elevation, 180.1 meters.

Instruments: Two Milne-Shaw horizontal pendulums, 0.45 kg.

		V	T_0	e	Sensitivity.
Instrumental constants...	E.	150	12	20:1	1″ arc tilt=26.6 mm.
	N.	150	8	20:1	1″ arc tilt=13.2 mm.

1919.			H. m. s.	Sec.	μ	μ	Km.	
Dec. 5		P	0 22 10				2,440	
		S	0 26 09					
		L	0 30 ..	30				
		F	1 *ca* ..					
14		eL	2					
		L	2 13 ..	18				
		L	2 16 ..	15				
		F	2 50 *ca*					
18		P	1 26 06					
		S	1 30 30					
		L?	1 33 00					
		F	2 *ca* ..					
20		eL	20 29 ..					
		L	20 35 ..	26				
		L	20 44 ..	15				
		F						Lost in micros.
20		eL	21 17 ..	*ca*26				
		L	21 20 30	*ca*30				
		L	21 35 ..	28				
		L	21 40 ..	24				
		L	21 47 ..	15				
		F	23 10 *ca*					
26		eL?	17					
		L	17 09 30	22				
		L	17 14 ..	16				
		F	17 40 *ca*					Do.
27		eL	21 13 ..	18				
		L	21 21 ..	16				
		F	22 *ca* ..					

TABLE 2.—*Instrumental seismological reports, December, 1919*—Continued.

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

(Report for December, 1919, not received.)

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

(No earthquake recorded during December, 1919.)

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

(Report for December, 1919, not received.)

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

(Report for December, 1919, not received.)

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

(Report for December, 1919, not received.)

New York. *Ithaca. Cornell University.* Heinrich Ries.

Lat., 42° 26′ 53″ N.; long., 76° 29′ 09″ W. Elevation, 242.6 meters.

Instruments: Two Bosch-Omori 25 kg. horizontal pendulums (mechanical registration).

Instrumental constants..		V	T_0	ε
	E	13	22	4:1
	N	14	25	4:1

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_A	Amplitude. A_B	Distance.	Remarks.
			H. m. s.	*Sec.*	*μ*	*μ*	*km.*	
1919. Dec. 5		e_B	0 23 45	4				
		o_N	0 27 56	4				
		e_Z	0 27 58	5				
		F	0 50 ..					
14		eL_B	2 18 30	18				
		F	2 30 ..					
20		L_B	21 34 30	38				
		L_B	21 43 27	22				
		F	22 63 ..					

New York. *New York. Fordham University.* D. H. Sullivan, S. J.

(Report for December, 1919, not received.)

Panama, Canal Zone. *Balboa Heights.* Governor, Panama Canal.

(Report for December, 1919, not received.)

Porto Rico. *Vieques. Magnetic Observatory.* U. S. Coast and Geodetic Survey. W. M. Hill.

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

Instruments: Two Bosch-Omori.

Instrumental constants..		V	T_0
	E	10	17
	N	10	19

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_A	Amplitude. A_B	Distance.	Remarks.
			H. m. s.	*Sec.*	*μ*	*μ*	*km.*	
1919. Dec. 5		P_B	0 20 59	5				
		eS_B	0 24 39					
		eN	0 25 35					
		eL_B	0 25 53					
		eL_N	0 33 00					
		M_B	0 25 59	13	*25			
		M_N	0 33 30	15		*20		
		F_B	0 36 ..					
		F_N	0 35 ..					

* Trace amplitude.

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

(No earthquake recorded during December, 1919.)

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 pendulum, one Spindler & Hoyer 80 kg. vertical seismograph.

Instrumental constants..	V	T_0
	120	26

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_A	Amplitude. A_B	Distance.	Remarks.
			H. m. s.	*Sec.*	*μ*	*μ*	*Km.*	
1919. Dec. 5		O?....	0 14 33				4,400?	
		P?....	0 22 20					
		P[illegible]?	0 23 38					
		S.....	0 28 30					S and L from the Deformation Instrument with a scale of 18 mm/hr.
		L.....	0 34 12					
		F.....	0 50 ..					
14		L_B....	2 17 to 2 30	16				N-S masked by micros.
		F.....	2 40 ..					
20		eL_B ..	21 28 to 21 40	40 20				N-S masked by very heavy micros. The record appears to be that of a severe quake at a distant epicentre.
		L_B....	21 42 ..	17				
		L_B....	21 50 ..	15				
		L_B....	21 59 ..	12				
		F.....	22 25 ..					

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 coustant..	T_0
	13.

Pillar deviation, 1 mm. swing of boom =0.45″.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_A	Amplitude. A_B	Distance.	Remarks.
			H. m. s.	*Sec.*	*μ*	*μ*	*Km.*	
1919 Dec. 3								Marked micros when other station records quake.
5		L.....	0 47 42					Phases masked by micros.
12		L.....	4 32 18					Small micros going on.
		L.....	4 34 00		*100			
14		eL.....	0 58 54					
		F.....	1 04 18		*200			
14		L.....	1 37 36		*100			
14		L.....	2 13 30					Earthquakes reported from Alaska on the 14th.
		eL.....	2 15 42					
		M.....	2 17 24		*300			
		eL.....	2 19 30					
		F.....	2 35 48					
14		L.....	3 23 00					
		L.....	3 26 30		*100			
		L.....	3 45 54					
15		L.....	20 18 30					
		F.....	20 22 30		*50			
17		L.....	0 21 42		*50			
		F.....						Micros.
20		o?.....	21 03 30					Marked micros render measurements doubtful.
		P?.....	21 05 42					
		S?.....	21 16 06					
		L.....	21 29 48					
		eL.....	21 41 00					
		M.....	21 44 06		*500		9,280	
		eL.....	21 51 06					
		eL.....	22 06 42					
		F.....						Micros.
21		L.....	18?48 54		*200			Micros going on.
23		eL.....	0 22 36					Small micros going on.
		L.....	0 26 48		*100			
26		L.....	17 16 12					Thickening.
		eL.....	17 19 36					
		M.....	17 22 18		*200			Light turned down at 17 h 37 m.
		F.....						

* Trace amplitude.

TABLE 2.—*Instrumental seismological reports, December, 1919*—Con.

Date.	Character.		Time.	Period T.	Amplitude. A_A	Amplitude. A_B	Distance.	Remarks.

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

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

Instrument: Wiechert, vertical: Milne horizontal pendulum, North: in the meridian. T_s

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

			H. m. s.	*Sec.*	*μ*	*μ*	*Km.*	
1919. Dec. 3		P	2 25 26				215	Off Pt. Estevan. Felt there and at Alert Bay Wireless Station.
		L	2 26 55					
		M	2 27 25		*100			
		F	2 30 21					
			VERTICAL.					
		P	*2 24 55*	*2.5*				
		L	*2 25 55*	*3*				
		M	*2 26 45*	3				
		F	*2 31 30*					
5		P	0 32 28					
		S	0 37 03					
		L	0 41 29					
		M	0 43 56		*200		2,760	
		F	0 55 44					
12		P	4 22 16					
		M	4 26 42		*200			
		F	4 35 03					
14		P	1 32 02					
		S	1 39 24					
		M	2 00 04		*200			
		F	2 29 05					
14		M	3 34 29		*50			
15		P?	20 16 59					
		M	20 18 57		*200			
		F	20 25 30					
18		P?	0 12 21					
		M	0 20 13		*50			
		F	0 25 08					
18		P	1 34 58					
		L	1 38 54					
		M	1 41 21		*300			
		F	1 49 43					
20		P	21 00 50					Marked micros from 20h 29m to 20h 44m.
		S	21 06 18					
		L	21 15 43					
		M	21 29 36		*500		3,670	
		L	21 38 50					
		L	22 14 20					
		F	22 43 28					
21		M	18 55 28		*50			May not be seismic.
23		P	0 23 38					
		M	0 32 59		*100			
		F	0 41 20					
26		P	16 56 58					
		M	17 01 24		*100			
		F	17 09 51					

* Trace amplitude.

SEISMOLOGICAL DISPATCHES.[1]

London, December 3, 1919.

A serious earthquake occurred in western Asia Minor on Thursday, seven villages in the district of Soma and Balikeari being destroyed, according to advices received here from Constantinople. Many persons were killed and injured, it is stated.—*Associated Press.*

Juneau, Alaska, December 14, 1919.

Juneau and vicinity were rocked at 4:10 p. m. to-day by one of the heaviest earthquakes experienced here in years. Buildings were badly shaken, but no material damage has been reported. It is believed the shocks centered about the Katmai Volcano, near Kodiak, and that the volcano may be in eruption again.—*Associated Press.*

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

TABLE 3.—*Late reports.* (*Instrumental.*)

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.

Hawaii. *Honolulu. Magnetic Observatory.* U. S. Coast and Geodetic Survey. Frank Neumann.

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. T_s ″

Instrumental constant..18.4 Sensitiveness 0.40 arc tilt-1 mm.

			H. m. s.	*Sec.*	*μ*	*μ*	*Km.*	
1919. Nov. 5		P	20 36 00	16				
		eL	20 43 06					
		M	20 47 42	15	*100			
		C	20 54 24					
		F	20 58 ..					
6		L	17 32 00					
		M			*100			
		F	17 44 ..					
18		eP	4 22 54					Hourly time breaks missing; time interpolated for an interval of 25 hours.
		L	4 32 24	22				
		M	4 50 18	17	*300			
		C	4 55 ..					
		F	5 16 ..	19				
18		P	23 00 24	15				
		L	23 05 00					
		M	23 11 00	20	*200			
		C	23 19 ..	18				
		F	23 26 ..					
20		iP	14 19 48	19				
		S	14 27 18					
		SR_1	14 32 00	14				Very sharply defined.
		L	14 38 42					
		M	14 42 42	15	*2,000			
		C	14 48 ..	16				
		F	15 36 ..	20				
23		eP	6 17 42	18				Phases indefinite.
		eS	6 23 48					
		L	6 30 30					
		M	6 35 00	17	*700			
		C	6 42 ..	19				
		F	7 25 ..	17				
26		e	8 30 30					
		M	8 31 00		*50			
		F	8 34 ..					

* Trace amplitude.

Porto Rico. *Vieques. Magnetic Observatory.* U. S. Coast and Geodetic Survey. W. M. Hill.

Lat., 19° 09′ N.; Long., 65° 27′ W. Elevation, 19.8 meters.

Instruments: Two Bosch-Omori.

		V	T_s
Instrumental constants..	E	10	17
	N	10	19

			H. m. s.	*Sec.*	*μ*	*μ*	*Km.*	
1919. Nov. 6		P	7 15 00					Beginning of a series of waves of small amplitude and period about 1s.
		S_N?	7 16 23					
		L_E	7 17 27					
		L_N	7 17 19					
		M_E	7 18 05	14	*60			
		M_N	7 18 02			*50		
		C	7 20 ..					
		F	7 24 ..					
8		eP_E	3 44 39			*10		Felt in several in Porto Rico.
		eP_N	3 45 18					
		F	3 47 ..					
22		P_E	1 09 02					
		P_N	1 08 42					
		M_E	1 09 43		*20			
		M_N	1 10 06	5		*20		
		F	1 14 ..					

* Trace amplitude.

EARTHQUAKES FELT IN THE UNITED STATES DURING 1919.

(Consult also Chart XVII in this issue.)

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

[Dated, Weather Bureau, Washington, Feb. 3, 1920.]

During the year 1919, 86 separate earthquakes strong enough to be noticeable to the senses were reported from different parts of the continental United States, as listed in the accompanying table, and graphically represented (a dot for each *report*) on Chart XVII at the end of this issue of the REVIEW.

Earthquakes of moderate intensities, V–VI (adapted Rossi-Forel scale), accompanied by slight damage or none at all, occurred in Arkansas on November 3; in California on January 25, February 10, 16, 19, 25, March 27, May 2, June 21, 24, July 20, September 12, 15, October 1, 2, and November 25; in Indiana on May 25; in Kansas on May 27; in New Mexico on February 1; and in Virginia on September 5.

The Virginia earthquake, of greatest intensity in the vicinity of Front Royal, Va., is fully treated in the MONTHLY WEATHER REVIEW for November, 1919, page 839.

Places in the United States reporting earthquakes during 1919.

(Consult also Chart XVII in this issue.)

Place.	Approximate latitude N.	Approximate longitude W.	Number of quakes reported.
	° ′	° ′	
ARIZONA.			
Flagstaff	35 12	111 37	1
ARKANSAS.			
Ravenden	36 30	91 11	1
CALIFORNIA.			
Aguanga	33 30	117 00	1
Amos	33 05	115 16	3
Anderson	40 30	122 22	1
Bakersfield	35 22	119 00	2
Barrett	32 43	116 46	2
Berkeley	37 52	122 16	3
Bishop	32 22	118 24	1
Brawley	32 59	115 40	2
Calexico	32 41	115 30	23
Centerville	37 30	122 00	1
Corona	33 52	117 35	1
Eureka	40 48	124 10	6
Fairmont	34 15	118 25	1
Glennville	35 45	118 42	2
Hemet	33 45	116 45	2
Idria	36 24	120 42	1
Imperial	32 50	115 35	1
Kennett	40 45	122 24	3
Lindsay	36 13	119 06	1
Livermore	37 40	121 45	1
Lone Pine	36 37	118 01	5
Lonoak	36 20	120 55	1
Los Angeles	34 03	118 15	1
Los Gatos	37 12	121 58	2
Lucerne Valley	34 27	116 57	1
Maricopa	35 05	119 23	3
Napa	38 18	122 20	2
Ojai	34 25	119 12	4
Oak Grove	33 26	116 51	1
Oakland	37 48	122 15	2
Paso Robles	35 40	120 45	1
Peachland	38 23	122 48	1
Petaluma	38 15	122 38	2
Point Reyes	38 02	122 59	1
Redding	40 35	122 25	1
Redlands	34 04	117 12	1
Riverside	33 58	117 21	1
Salinas	36 36	121 40	3
St. Helena	38 41	122 30	1
San Diego	32 43	117 10	1
San Francisco	37 48	122 26	4
San Jose	37 15	121 53	1
San Luis Obispo	35 18	120 39	3
San Pedro	32 45	118 14	2
Santa Barbara	34 23	119 40	1
Santa Cruz	36 55	122 00	1
Santa Rosa	38 30	122 45	1
Spreckles	36 35	121 38	1
Springville	36 07	118 50	1
Squirrel Inn	34 07	117 19	1
Stanford Univ	37 26	122 12	2
Vallejo	38 07	122 18	1
ILLINOIS.			
McLeansboro	38 07	88 33	1
Cairo	37 00	89 10	1
Mount Carmel	38 25	87 48	1
Olney	38 05	88 07	1
Springfield	39 48	89 39	1
INDIANA.			
Bonneville	38 04	87 16	1
Evansville	37 58	87 33	1
Mount Vernon	37 56	87 54	1
New Harmony	38 08	85 56	1
Petersburg	38 31	87 15	1
Princeton	38 23	87 34	1
Vincennes	38 42	87 32	1
Washington	38 40	87 11	1
KANSAS.			
Wichita	37 41	97 20	2
KENTUCKY.			
Hickman	36 34	89 12	4
Bardwell	36 52	89 01	1
Louisville	38 15	85 45	1
Taylorsville	38 02	85 21	1
MISSOURI.			
New Madrid	36 35	89 32	1
NEW MEXICO.			
Socorro	34 08	106 48	1
OREGON.			
Bullrun	45 30	122 12	1
TENNESSEE.			
Tiptonville	36 24	89 30	1
UTAH.			
Moroni	39 32	111 30	1
VIRGINIA.			
Front Royal	38 55	78 10	1