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.
		CALIFORNIA.								
	H. m.		° ′	° ′			*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.. E: V 10, T_0 17; N: V 10, T_0 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.. E: V 10, T_0 15; N: V 10, T_0 13

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_E	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_E	7 44 ..					
		F_E	7 56 ..	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′ 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.
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° 56′ 54″ W. Elevation, 1,655 meters.

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

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
15		P	16 33 ..					Heavy machinery in motion nearby during first portion of record.
		S	(7)					
		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.

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	3.0	0

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	*μ*	*μ*	*Km.*	
Sept. 1		I_N	20 06 ..	22				Heavy microseism.
		F	20 10 ..					
6		iP_N	1 45 56					
		eP_N	1 46 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 27*					
		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

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

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

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

Instrumental constant T_0 18.4. Sensitivity, 0.40″.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			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 38 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.

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.
			H. m. s.	*Sec.*	*μ*	*μ*	*Km.*	
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					
		L?	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 ..					

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

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	*μ*	*μ*	*Km.*	
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		eP_E	11 34 03	3				Possibly not seismic.
		eP_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′ 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 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.

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

(Report for September, 1919, not received.)

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

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 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	ϵ
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

			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 Goedetic 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

			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 36	.....	.....	.....	.....	
		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.

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

			H. m. s.	*Sec.*	μ	μ	*Km.*	
Sept. 6	.....	e	9 36 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

			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 los in microseisms L waves very irregular.
		L?	10 13 ..	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 30 ..	.....	.....	.....	.....	
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 ..	.....	.....	.....	.....	
26	.....	i_N?	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 .. 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	.....	O?....	3 34 32	.....	.....	.....	4,080	
		$eP?_N$..	3 41 56	.....	.....	.....	.....	
		PR_1...	3 43 36	.....	.....	.....	.....	
		$eS_N?$..	3 47 48	.....	.....	.....	.....	
		eL....	3 55 ..	22	.....	.....	.....	
		L_E....	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	.....	.....	Micros 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 59	.....	.....	.....	.....	
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.*)

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.. E: V 165, T_0 5.4, ϵ 0; N: V 143, T_0 5.2, ϵ 0; Z: V 80, T_0 3.0, ϵ 0

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Sec.*	*n*	*μ*	*Km*	
Aug. 29	.....	eP_E...e	6 06 17	.....	.....	.....	.....	Heavy microseisms.
		eP_N...	6 06 28	.....	.....	.....	.....	
		eL_E...	6 26 00	17	.....	.....	.....	
		eL_N...	6 26 12	17	.....	.....	.....	
		F.....	8 00 ..	.....	.....	.....	.....	
31	.....	e_E...	17 39 22	.....	.....	.....	.....	
		e_N...	17 40 26	.....	.....	.....	.....	
		S_E...e	17 51 00	.....	.....	.....	.....	
		eL....	18 05 24	11	.....	.....	.....	
		F.....	19 10 ..	.....	.....	.....	.....	
			Vertical.					
29	.....	*eP*....	*6 06 28*	.....	.....	.....	.....	
		L.....	*6 56 06*	*19*	.....	.....	.....	
		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.

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.
			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.

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.. E: V 13, T_0 22, ϵ 4:1; N: V 14, T_0 25, ϵ 4:1

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
			H. m. s.	*Secl*	*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_E....	0 42 48	5	.....	.....	.....	
		LZ_N...	0 45 22	8	.....	.....	.....	
		F_N....	0 57 ..	.....	.....	.....	.....	
17	.....	P_N....	16 26 20	3	.....	.....	.....	
		eS_N...	16 31 46	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 06 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_E....	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.

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.
			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		o?	17 28 47				8,540	N.-S. and E.-W. records very dissimilar. Very difficult to read.
		oP_N?	17 39 20					
		iP_E	17 40 33					
		e_E	17 47 08					
		eS_E?	17 50 23					
		e	17 48 30					
		e	17 51 10					
		eL_N?	18 07 ..					
		eL_N	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″.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
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?		*300			
		eL	17 53 54					
24		L	5 15 12		*100			
		F	5 18 48					
24		iL?	5 29 18					
		M	5 29 36		*200			Last phase gradual thickening.
		eL	5 35 48					
		L	6 00 33?					
		F	6 05 36					
24		L	12 45 54					
		L	12 58 54		*50			

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

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
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. Small micros make interpretation difficult.
		e	6 06 48					
		L	6 16 18					
		L	6 34 54					
		L	6 50 48					
		i	6 54 36					
		i	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 Sesvice.*

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.
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 10					
		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.