SECTION V.—SEISMOLOGY.

SEISMOLOGICAL REPORTS FOR MARCH, 1915.

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[Dated, Weather Bureau, Washington, D. C., Apr. 28, 1915.]

TABLE 1.—*Noninstrumental earthquake reports, March, 1915.*

Day.	Approximate time Greenwich Civil.	Station.	Approximate latitude.	Approximate longitude.	Intensity Rossi-Forel.	Number of shocks.	Duration.	Sounds.	Remarks.	Observer.
		CALIFORNIA.								
	H. m		° ′	° ′			*M. s.*			
1	17 15	Brawley	32 59	115 40	4	1		Rumbling		M. D. Witter.
4	12 50	Julian	33 05	116 37	5	1	8	Rumbling		J. H. L. Vogt.
12	14 00	Cahuilla	33 32	116 43	4	1	2	Rumbling		Dr. W. L. Shawk.
17	3 25	Arbolado	36 15	121 47	3	1	1	Rumbling		Forest Service.
19	19 04	Rialto	34 12	117 27	2	2	4			So. Cal. Edison Co.
29	13 40	China Flat	40 56	123 30	1	1	3			O. I. Westerburg.
30	18 00	Brawley	32 59	115 40	1	1				M. D. Witter.
		IDAHO.								
15	3 35	Montpelier	42 20	111 17	5	1		Rumbling		Forest Supervisor.
		MICHIGAN.								
3	7 45	Calumet	47 13	88 26	3-4	1		Rumbling	Mine caving in?	E. S. Grierson.
		MONTANA.								
4	15 00	Lytle	48 01	111 26	3	1	30	Rumbling		J. F. Fait.
4	8 30	Shelby	48 30	111 55	2	1	4			O. C. Fjeld.
		WASHINGTON.								
1	3 00	Lakeside	47 50	120 00	3	1				W. H. Van Meter.
6	5 10	Lakeside	47 50	120 00	1	1				W. H. Van Meter.
6	5 30	Lakeside	47 50	120 00	4	1	5	Rumbling	Shook buildings	W. H. Van Meter.
		WYOMING.								
31	18 30	Bedford	42 56	110 56	4	1	8	Rumbling	Shook buildings	C. G. Heiner.

TABLE 2.—*Instrumental reports, March, 1915.*

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

[For significance of symbols see this REVIEW, December, 1914, p. 689.]

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

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

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

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

Date.	Character.	Phase.	Time.	Period. T	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915.			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Mar. 5		e_N	4 23 06	6				
		e_E	4 22 46	10				
		M_N	4 25 04	8		100		
		M_E	4 23 36	10	30			
		C	4 28 00	6				
		F	4 39 00	6				
28		P_E	19 52 07	2				
		P_N	19 52 10					
		L_E	19 55 22	5				
		L_N	19 56 23	3				
		M_E	19 57 08	6	30			
		M_N	19 57 23	4		20		
		C	20 02 00	5				
		F	20 10 00	3				

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.
1915.			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Mar. 1			7 51 —					Minor earthquake at Grand Junction, Colo. Very slight tremors recorded.
			7 52 —					
3			9 59 —					Slight sinusoidal curve, but not regular.
			10 00 —					
5			23 59 —					Very small, irregular waves, especially on N-S, recurring several times during the day.
6			0 06 —					
6								Activity: thickening of penmarks; possibly connected with quake reported from Abruzzi Provinces, Italy.

TABLE 2.—*Instrumental reports, March, 1915*—Continued.

Colorado. **Denver. Heart College.** Earthquake Station—Contd.

Date.	Character.	Phase.	Time	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915.				*Sec.*	*μ*	*μ*	*Km.*	
Mar. 13			18 39 —					Very strange record of broken waves especially strong on N-S.
			18 45 —					
			18 45 —					
			19 00 —					
24								Activity; thickening of penmarks at times during the day.

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

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

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

Instrumental constants.. V 110 T_0 6

Date.	Character.	Phase.	Time	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915.			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Mar. 5		e_N	4 34 36	4				No distinct maximum.
		L_N	4 35 47	10				
		F	4 47 00					
20		e_N	22 34 47					Beginning uncertain.
		L_E	22 45 01					Phases doubtful.
		F	22 51 00					

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

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

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

Instrumental constant.. T_0 18.9

Date.	Character.	Phase.	Time	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915.			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Mar. 5		e	4 37 42	23				
		M	4 41 42		400*			
		C	4 51 00					
8		P	15 47 12					
		L	15 56 30	22				
		M	15 59 48		400*			
		C	16 51 06					
		F	16 45 30					
10		P	1 09 42					
		L	1 25 54	23				
		M	1 30 42		300*			
		C	1 34 12					
		F	2 09 48					
11		e	16 36 06	24				
		M	16 39 48		200*			
		C	16 45 00					
		F	16 50 00					
11		P	18 25 30					
		L	18 34 00	22				
		M	18 41 12		800*			
		C	18 52 54					
		F	19 17 06					
12		P	15 08 42					
		S	15 15 42					
		L	15 24 42	24				
		M	15 33 54		800*			
		C	15 46 30					
		F	17 31 00					
17		e	19 01 54					F occurred during daily attention to instrument.
		M	19 02 54	20	400*			
		M	19 16 06	20	400*			
		C	19 21 06					
18		e	1 56 48	20				
		M	2 02 00		200*			
		C	2 08 30					
		F	2 25 30					
28		e	18 57 18					Beginning obscured by air tremors.
		M	18 58 18		200*			
		C	19 08 54					F occurred during daily attention to instrument.
31		e	18 32 30					
		M	18 36 48		200*			
		C	18 44 00					
		F	18 50 00					

*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, 304.8 meters.

Instrument: Wiechert.

Instrumental constants.. V T_0 ϵ E 121 3.7 3.7; N 126 3.7 4.5

Date.	Character.	Phase.	Time	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Mar. 5		P_N	4 22 25				2,370	
		S_N	4 26 20					
		M_N	4 28 10					
		M_E	4 28 10					
12		P_N	5 21 15				120?	
		S_N?	5 21 27					
		M_N	5 21 38					
20		P_N	22 23 08				2,620	
		M_E	22 31 04					

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 31; N 10 29

Date.	Character.	Phase.	Time	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Mar. 5		e_N	4 34 22					
		e_E	4 34 25					
		M_N	4 35 40	10		30		
		M_E	4 37 40	10	10			
		C	4 41 00					

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

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

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

Instrumental constants.. V T_0 E 80 23; N 50 25

Date.	Character.	Phase.	Time	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915.			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Mar. 5		e_N	4 36 26					
		L_E	4 37 43					
		L_N	4 37 58	7				
		F	4 49 28					
12		e_N	15 53 12					Masked by microseisms.
		L_N	15 56 35	18				
		L_N	16 01 59					
		F	16 05 00					
20		e?	22 — —					F lost in microseisms?
		L_N	22 51 12?	18				
31		e	17 53 16					Masked by microseisms and confused in tangled lines.
		L_E	17 54 36					
		F?	18 01 —					

TABLE 2.—*Instrumental reports, March, 1915*—Continued.

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 80, T_0 7, ε 5:1

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Mar. 5	II_r..	eP?...	4 21 46				3,475	
		iS_E...	4 27 00					
		iS_N...	4 27 02					
		eL....	4 29 12					
		M_E...	4 29 58	8	9			
		M_N...	4 29 58	8		10		
		M_N...	4 30 36	9		16		
		F....	4 44 00					

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

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

Instrument: Wiechert 80 kg. horizontal.

Instrumental constants: ————.

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Mar. 1			4 19 00					Earth tremors, N-S.
			4 21 00					
			4 43 00					
			4 44 00					
4	I_u...	eP_E...	4 23 00				7232?	Reported in Florence, Italy.
		S_E...	4 34 00					
		L_E...	4 35 00	12	450*			
		L_N...	4 35 00			150*		
		F_E...	4 38 45					
11								Earth tremors, N-S.
12								Earth tremors, N-S.
30	I_u...	P?...	17 28 00					S indiscernible. Distant earthquake?
		L_E...	17 54 00	10	250*			

* Trace amplitude.

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

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

Instrument: Wiechert 80 kg.

Instrumental constant.. T_0 6

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Mar. 4	I....	iL_N...	18 00 00					Because of repairs being made to the station clock, the time of each phase of this report is only approximate.
		iL_E...	18 00 30					
		M_N...	18 00 00	13		13		
		M_E...	18 00 30	13	28			
		M_E...	18 02 25	13	14			
		F_N...	18 04 45					
		F_E...	18 05 00					
5	I....	eL_N...	3 13 00					Time of each phase approximate.
		M_N...	3 15 00	6.5		2		
		M_N...	3 15 15	6.5		2		
		M_N...	3 15 50	8.2		3		
		M_E...	3 17 40	7	2			
		M_E...	3 19 15	7	2			
		F....	3 30 00					

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

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

Instruments: Two Bosch-Omori 25 kg.

Instrumental constants.. V 8, T_0 20

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Mar. 14	III..							No record. Seismograph room in repair. Disturbance began at 12:25 p. m.
23	I....	P_E...	9 26 20				620	
		P_N...	9 26 20					
		L_E...	9 27 40					
		L_N...	9 27 40					
		M_E...	9 28 15		188			
		M_N...	9 29 35			250		
		F_N...	9 34 40					
		F_E...	9 36 00					

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 20, N 25), T_0 (E 15, N 16)

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Mar. 5		e_N...	4 36 12					No well defined maximum.
		L_N...	4 37 23	11				
		F....	5 00 00					
12		L_N...	16 01 30					No maximum.
		F....	16 12 00					
17		L_N...	19 07 50	12				Phases doubtful.
		L_N...	19 10 15	14				
		F....	19 30 00					

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

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

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

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915.			*H. m. s.*	*Sec.*	μ	μ	*Km.*	
Mar. 2		P_E...	21 22 46	2			1300	
		L....	21 25 07	12–20				
		F....	21 30 00					
5		L....	4 36 00	20				P and S masked by microseisms.
		M_E...	4 36 08	20	12			
		M_N...	4 37 03	20		40		
		F....	5 00 00					
12		L....	15 56 00	24				
		F....	16 10 00					
17		P....	18 57 29	5			9050	
		S....	19 07 42	6				
		L_E...	19 23 05	12				
		L....	19 26 00	60				
		L....	19 31 00 / 19 41 00	24 to 18				
		F....	19 50 00					
20		e_E...	22 31 00	7				Microseisms strong.
		i....	22 38 00	6				
		L_E...	22 41 00	9				
		F....	22 52 00					
23		e_E...	21 38 48	4				Somewhat masked by microseisms.
		eL_E...	21 41 08	16				
		L_E...	21 46 00	20				
		L_N...	21 47 05	20				
		F....	21 55 00					
31		e?...	17 29 26					
		L....	17 54 04	20				
		F....	18 02 00					

TABLE 2.—*Instrumental reports, March, 1915*—Continued.

Canada. **Toronto. Dominion Meteorological Service.**

Lat., 43° 40′ 01″ N.; long., 79° 22′ 54″ W. Elevation, 113.7 meters. Subsoil: Sand and clay.

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

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

Date.	Character.	Phase.	Time.	Period T.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915.			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Mar. 5		L	4 35 06					
		iL	4 35 18					
		M	4 35 42		600*			
		i	4 37 18					
		M	4 37 36		400*			
		F	4 52 00					
11		P	18 54 00					Time of P uncertain.
		S	19 09 06					
		SR	19 12 12					
		L	19 16 18					
		iL	19 19 18					
		M	19 22 18		300*			
		F	19 55 00					Time of F uncertain.
12		P	15 25 30					Time of P uncertain.
		iS	15 38 12					$15^h\ 53^m\ 54^s$ may be the beginning of another earthquake.
		iL?	15 53 54					
		L	15 58 00					
		iL	16 04 24					F doubtful, suspicion of air currents going on.
		M	16 10 18		200*			
		F	16 38 00					
17		S?	19 08 06					
		iL	19 35 54		100*			
		F						F lost in air currents.
20		P	22 12 30					Strong microseisms prevailed.
		S	22 18 54					
		L	22 24 30					Suspicion of air currents.
		L	22 35 48		100*			
		L	23 00 00					
		F	23 14 00					
23		P	21 30 00					Time of P uncertain.
		L	21 42 54					
		iL	21 45 06					
		M	21 46 48		500*			
		L	22 08 00		200*			
		F	22 12 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: 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.
1915.			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Mar. 5		iL	4 33 38					
		M	4 35 38		500*			
		F	4 43 08					
11		P	18 50 42					
		L	18 58 42					
		M	19 03 42		100*			
		F	19 13 42					
12		P	15 14 39					Time uncertain.
		L	15 27 39					
		M	15 29 39		100*			
		F	15 34 39					
12		P	15 48 39					May be a continuation of the preceding. All times uncertain.
		L	16 02 39					
		M	16 03 39		100*			
		F	16 22 39					
17		P	19 02 22					
		M	19 11 22		200*			
		F	19 25 22					
23		L	21 55 00					Phases not well defined.
		L	21 59 00					
		M	22 00 30		200*			
		F	22 05 00					

* Trace amplitude.

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

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 80 T_0 7 ε:1 5:1

Date.	Character.	Phase.	Time.	Period.	Amplitude. A_E	Amplitude. A_N	Distance.	Remarks.
1915.			*H. m. s.*	*Sec.*	*μ*	*μ*	*Km.*	
Feb. 25	I	eP	20 58 38				8,000	S probably mersed in local disturbance.
		eS?	21 08 00					
		M_E	20 59 24	5	8			
		M_N	20 59 54	7		9		
		F	21 12 00					Microseisms were of frequent occurrence throughout the month.