

THE PANAMA CANAL
DEPARTMENT OF OPERATION AND MAINTENANCE
SECTION OF SURVEYS

SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Lat. 8° 57' 39" N.

Long. 79° 33' 29" W.

h = 36 meters.

Time Correction: Within 0.5 sec.

Lithologic foundation: Basalt.

INSTRUMENTS—FIXED CONSTANTS

INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED		MASS
				60 mm. per min.	15 mm. per min.	1.3 gr. 100 kg.
Wood-Anderson	I	Photographic	Magnetic	60 mm. per min.		
Bosch-Omori	II	Smoked Sheet	Air	15 mm. per min.		

INSTRUMENTS—DETERMINED CONSTANTS

INSTRUMENTS	COMPONENT	T.	V	h	DETERMINED
		Not	Operat	ing	
Wood-Anderson	-----	Not	Operat	ing	
Wood-Anderson					August 1, 1933.
Bosch-Omori	E-W	20	35	critical	August 1, 1933.
Bosch-Omori	N-S	20	35	critical	August 1, 1933.

Month JANUARY, 1934.Page No. 1.

No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS
		h	m	s		E mm	N mm	
II 884 Jan. 15		9:44						Very faint on E-W. No record on N-S Press reports severe quake in Calcutta, India.
II 885 Jan. 29		19:15						Very faint record. Destructive in Mexico.

R. Z. KIRKPATRICK,
Chief of Surveys.

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Wood-Anderson	I	Photographic	Magnetic	60 mm. per min.	1.3 gr. 100 kg.
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INSTRUMENTS—DETERMINED CONSTANTS

INSTRUMENTS	COMPONENT	T.	V	h	DETERMINED
Wood-Anderson		--- Not	operating ---		
Wood-Anderson					
Bosch-Omori	E - W	20	35	Critical	August 1, 1933.
Bosch-Omori	N - S	20	35	Critical	August 1, 1933.

Month February 1934Page No. 2

No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS
		h	m	s		E mm	N mm	
II 886 Feb. 2		9:	44					Very faint short period waves
			to					
		9:	46					
II 887 Feb. 8		16:	38					Very faint, but certainly seismic
			to					
		16:	40					
II 888 Feb. 8	e P N e P E e S N e S E F N E	22:	29:	31				Faint record. Dist. approx. 220 miles. Several persons visiting El Volcan, Chiriqui, Province, Republic of Panama, report rather severe undulations of the ground and swaying of trees, lasting for several seconds.
		22:	29:	30				
		22:	30:	08				
		22:	30:	07				
		22:	34:	00				
II 889 Feb. 9		15:	14					Very faint short period waves.
			to					
		15:	16					
II 890 <i>Feb. 12</i>	e P N e P E i S N i S E M N M E C N C E F N E	6:	44:	23				Disturbance approximately 200 miles Felt by a few people in Balboa, C.Z. Also visitors to El Volcan, Chiriqui Province, Republic of Panama, report same indications as N. 888.
		6:	44:	22				
		6:	44:	55				
		6:	44:	56				
		6:	45:	30		8.1		
		6:	45:	29	5.2			
		6:	48:	05				
		6:	47:	32				
		6:	56:	00				
II 891 Feb. 12		24:	33					Very faint short period waves.
			to					
		24:	36					

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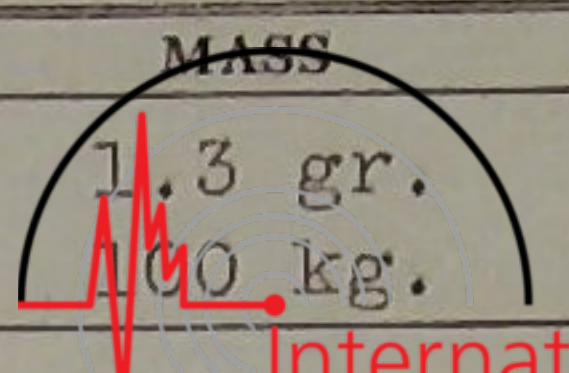
Time Correction: Within 0.5 sec.

INSTRUMENTS—FIXED CONSTANTS

INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED	MASS
Wood-Anderson	I	Photographic	Magnetic	60 mm. per min.	1.3 gr. 100 kg.
Bosch-Omori	II	Smoked Sheet	Air	15 mm. per min.	

INSTRUMENTS—DETERMINED CONSTANTS

INSTRUMENTS	COMPONENT	T _o	V	h	DETERMINED
Wood-Anderson		Not operating			
Wood-Anderson					
Bosch-Omori	E - W	20	35	Critical	August 1, 1933
Bosch-Omori	N - S	20	35	Critical	August 1, 1933



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Month MARCH 1934

Page No. 3

No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS
		h	m	s		E mm	N mm	
II 892 March 7		22:44						Very faint. U.S.C.G.S. - 14° N Lat. 88° W Long.
II 893 March 22		15:58						Very faint short period waves.
II 894 March 28	ePN ePE iSN iSE FNE	6:32:32						Light tremor. Felt by a very few people. Distance 100 miles.

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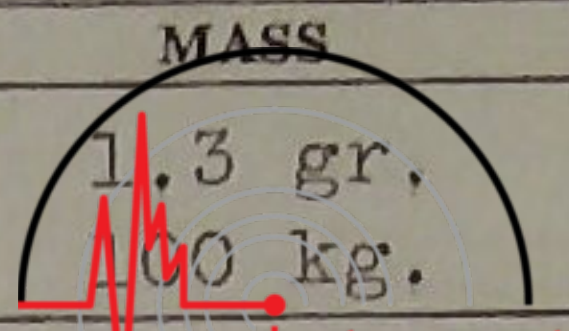
Long. 79° 33' 29" W.

h=36 meters.

Lithologic foundation: Basalt.

Time Correction: Within 0.5 sec.

INSTRUMENTS—FIXED CONSTANTS

INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED		MASS
				60 mm. per min.	15 mm. per min.	1.3 gr. 100 kg.
Wood-Anderson	I	Photographic	Magnetic	60 mm. per min.		
Bosch-Omori	II	Smoked Sheet	Air	15 mm. per min.		

INSTRUMENTS—DETERMINED CONSTANTS

INSTRUMENTS	COMPONENT	T.	V	h	DETERMINED
Wood-Anderson		-----NOT OPERATING-----			
Wood-Anderson					
Bosch-Omori	E-W	20	35	Critical	August 1, 1933.
Bosch-Omori	N-S	20	35	Critical	August 1, 1933.

Month APRIL, 1934Page No. 4

No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS
		h	m	s		E	N	
						mm	mm	
II 895 April 18	ePNE ISNE FNE	6:	59:	46				Very faint Distance approx. 120 miles.
II 896 April 21		15:12 to 15:14						Very faint short period waves.

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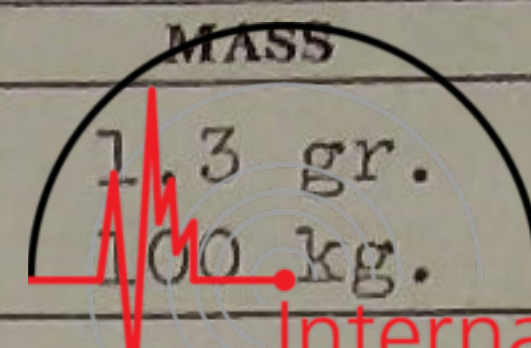
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INSTRUMENTS—FIXED CONSTANTS

INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED	MASS
Wood-Anderson	I	Photographic	Magnetic	60 mm. per min.	1.3 gr. 100 kg.
Bosch-Omori	II	Smoked Sheet	Air	15 mm. per min.	

INSTRUMENTS—DETERMINED CONSTANTS

INSTRUMENTS	COMPONENT	T _c	V	h	DETERMINED
Wood-Anderson)	- - - -	Not operating			- - - -
Wood-Anderson)					
Bosch-Omori	E-W	20	35	critical	August 1, 1933
Bosch-Omori	N-S	20	35	critical	August 1, 1933



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Month May, 1934

Page No. 5

No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS
		h	m	s		E mm	N mm	
II 897 May 4		7	00	52				Very faint trace
			to					
		7	04	00				

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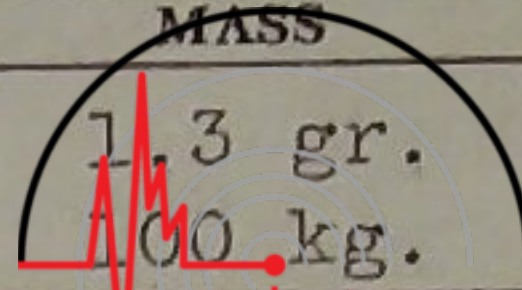
Long. 79° 33' 29" W.

h = 36 meters.

Lithologic foundation: Basalt.

Time Correction: Within 0.5 sec.

INSTRUMENTS—FIXED CONSTANTS

INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED	MASS
Wood-Anderson	I	Photographic	Magnetic	60 mm. per min.	
Bosch-Omori	II	Smoked Sheet	Air	15 mm. per min.	

INSTRUMENTS—DETERMINED CONSTANTS

INSTRUMENTS	COMPONENT	T _c	V	h	DETERMINED
Wood-Anderson)	Not operating				
Wood-Anderson)					
Bosch-Omori	E-W	20	35	critical	August 1, 1933
Bosch-Omori	N-S	20	35	critical	August 1, 1933

Month June 1934Page No. 6

No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS
		h	m	s		E mm	N mm	
II 898 June 4		15	38	26				Very faint - short waves
			to					
		15	42	00				
II 899 June 24		6	07					Very faint waves from distant disturbance
		6	34					
II 900 June 30	ePNE	15	04	11				Distance approximately 100 miles.
	1SNE	15	04	30				
	FNE	15	08	00				

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INSTRUMENTS—FIXED CONSTANTS

INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED	MASS
Wood-Anderson	I	Photographic	Magnetic	60 mm. per min.	1.3 gr. 100 kg.
Bosch-Omori	II	Smoked Sheet	Air	15 mm. per min.	

INSTRUMENTS—DETERMINED CONSTANTS

INSTRUMENTS	COMPONENT	T.	V	h	DETERMINED
Wood-Anderson	N - S	0.8	1370	Critical	July 18, 1934.
Wood-Anderson	E - W	0.8	1370	"	" " "
Bosch-Omori	N - S	20.0	35	"	" " "
Bosch-Omori	E - W	22.0	35	"	" " "

Month July 1934.Page No. 7

No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS
		h	m	s		E mm	N mm	
II 901 July 7	ePNE eSNE FNE	22	33	38	✓			Very faint. Distance approximately 60 miles.
		22	33	49				
		22	36	00				
II 902 July 13	ePN ePE iSNE MNE FNE	11	30	32	✓			Distance approximately 220 miles.
		11	30	31				
		11	31	12		5.3	13.5	
		11	31	28				
		11	36	00				
II 903 July 18	PNE	01	36	16				Intensity V (Note: all intensities are given as observed at Balboa Heights.)
			36	36	Pen thrown off		E - W	
			36	57	"	"	"	N - S
Pen was reset 02:00:00, and the earth continued to tremble until 03:07 with distinct aftershocks superposed as follows: (This shock set off Wenner Accelerometer.) Distances of all quakes recorded are from 200 to 250 miles.								
II 904 905 906 907 908	iPNE	02	13	08		1.5	2.0	
			34	04		1.5	2.1	
			35	19		1.0	2.2	
			38	45		1.4	2.1	
			46	59		1.0	1.0	
II 909 910 911 912		02	51	58		4.0	4.1	
		03	02	59				
			16	51		3.1	4.0	
			24	27		1.0	1.5	
913		04	01	32				
			02	18	Pen thrown off			N - S)
			02	29	"	"	"	E - W) Intensity IV.
There were no further records until 15:03 the 18th. From 13:00 to 15:03 observers were in seismograph room adjusting the Bosch-Omori seismographs which were thrown out of alignment. During this time several shocks were noticed.								
Telegraphic advices from David, R. P., indicate that seismic activity continued throughout the night, the entire population sleeping in the streets, plazas and patios; the two main shocks causing considerable damage especially to adobe buildings, and minor injuries to quite a few people. Damage estimated at \$50,000.								
At Fort Davis, Canal Zone, Private Kiernan, terrified by the tremors which shook the concrete barracks, leaped to his death from a third story window. Private Conroy, sleeping on the floor below, also jumped, but sustained only minor injuries.								

SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month July 1934.Page No. 8

No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS
		h	m	s		E mm	N mm	
July 18	N - S	Bosch-Omori seismograph started operation 14:51						
914		14	59	04	✓			E - W not operating
			to					
		14	04	33				
	E - W	Bosch-Omori started at 15:03						
915		15	11	35	✓			
			to					
		15	14	06				
		Wood-Anderson seismograph started at 15:39.						
916		15	48	09	✓			
			to					
I & II		15	52	10				
917		16	10	39	✓			Intensity III. Main phases blurred on account of too rapid movement of light beam.
		16	26	00				
	I	16	10	41	3.0			
	IPNE		11	20				
	ISN	11	22					
	ISE	11	46					E - W pen thrown off
		11	51					N - S " " "
		13	39					E - W pen returned own accord.
		14	00					N - S " " " "
	FNE	26	00					
July 18		17	00	29	✓			Intensity IV to V. Main phases blurred account of too rapid motion of light beam.
918		17	38	00				
	I	17	00	29	✓			
	IPNE		00	41				
		01	18					N - S pen thrown off.
919		17	39	46	✓			Very weak.
		17	44	00				
920		17	44	26	✓			Very weak.
		17	48	30				
921		17	56	17	✓			Intensity I
		18	08	45				



SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month July 1934.

Page No. 9

No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS
		h	m	s		E mm	N mm	
922		18	37	11	✓			Not recorded on Wood-Anderson. Sheets being changed.
		18	41	00				
923		19	17	00	✓			Very weak.
		19	25	00				
924		20	10		✓			Very faint trace of long period (approximately 23 seconds) waves appear intermittently.
		21	15					
July 18 925		22	10	21	✓			Very weak.
		22	13	50				
926	1PNE 1SNE MN ME FNE	23	03	34	✓			Section of Wood-Anderson records blotted out. Watchman flashed his light in seismograph room. Intensity II.
			04	17				
			05	06	4.0		13.1	
			04	32	5.0		30.0	
			13	00				
927		23	16	29	✓			Very weak.
		25	20	00				
July 19 928		02	21	58				Main phases blurred.
		02	32	00				Intensity I.
	1PNE 1SNE MN ME FNE	02	22	00	✓			
			22	40				
			22	58	4.0		15.0	
			23	16	5.0	12.1		
			32	00				
929		02	32	30	✓			Weak.
		02	38	00				
930		02	38	41	✓			Very weak.
		02	47	00				
July 19 931		03	21	36	✓			Very faint.
		03	26	00				



SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month July 1934

Page No. 11

No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS
		h	m	s		E mm	N mm	
July 19 941	1PNE FNE	16	28	38 29 20 35 00				Intensity I.
	1PNE 1SNE MN ME FNE	16	28	38 29 19 29 29 29 26 35 00	✓	2.5	5.0	
942		17	34	30 to 17 37 00	✓			Very faint.
943	1PNE 1SNE FNE	19	55	27 56 10 L & M blurred. 20 02 00				Intensity I.
	1PNE 1SNE MN ME FNE	19	55	31 56 13 56 23 56 20 20 02 00	✓	2.5	6.7	
944		20	16	53 to 20 20 00	✓			Weak.
945		20	48	15 to 20 51 00	✓			Very weak.
July 19 946		24	15	00 to 24 20 00	✓			2 very weak tremors superposed.
July 20 947		03	36	07 to 03 39 00	✓			Very faint.
948		15	24	18 to 15 27 00	✓			Very faint.
July 20 949		24	02	00 to 24 08 00	✓			Weak.



SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month July 1934.

Page No. 12

No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS
		h	m	s		E mm	N mm	
July 20 950		I & II 24 44 14 to 24 52 00		✓			Weak.	
July 21 951		I & II 04 47 45 to 04 53 00		✓			Weak.	
952		I & II 08 12 50 to 08 15 00		✓			Very faint trace	
953	1PNE	I 10 40 06 S - L & M		blurred				
	1PNE	II 10 40 06 40 49 40 51 42 55		✓			E - W pen thrown off. N - S pen thrown off. E - W pen returned own accord.	
	CE	51 39						
	FNE	uncertain		3 aftershocks superposed.				
<p>Intensity of this shock as recorded at Balboa Heights was about IV. (Did not start Wenner Accelerometer.) This shock did considerable damage at both David and Puerto Armuelles, the damage being estimated at \$750,000. About 400 feet of the deep-water section of the Government pier at Puerto Armuelles collapsed and sank into the sea, taking three banana conveyors, belonging to the Chiriqui Land Company, valued at \$250,000. Also 17 houses and a large water tank, the main water supply of the town, were destroyed. No serious personal injuries reported.</p>								
954	1PNE	I & II 11 02 44		✓			Superposed - weak.	
955	1PNE	11 08 12		✓			" "	
956	1PNE	11 15 36		✓			" "	
957		I & II 12 02 to 12 07		✓			Very faint trace.	
958	1PE	II 13 20 18		✓			Intensity II	
	1SE	21 08					No records on N-S or on Wood-	
	ME	21 45	5.0		15.6		Andersons. Sheets being changed.	
	FE	31 00						
959		I & II 16 22 to 16 27		✓			Very faint trace.	
960		I & II 17 10 20 to 17 14 00		✓			Very faint trace.	

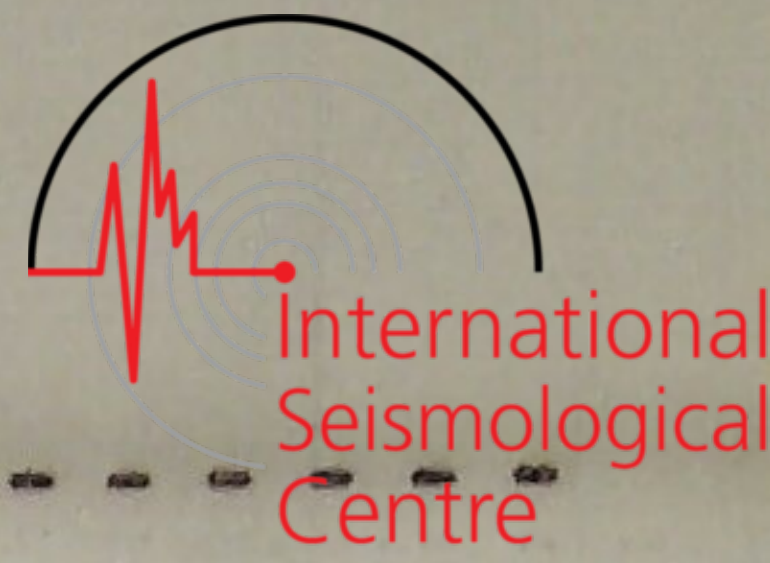


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Month July 1934

Page No. 13

No. and Date	Phase	Time G. M. T.			Period	Amplitude		REMARKS
		h	m	s		E mm	N mm	
July 21 961		I & II 19 00 15 to 19 04 00		✓			Very faint trace.	
962		I & II 21 26 51 to 21 29 00		✓			Very faint trace.	
July 22 963		01 23 07 to 01 29 00		✓			Weak. 2 shocks superposed.	
964		I & II 06 43 39 to 06 49 00		✓			Weak.	
965		I & II 07 12 50 to 07 15 00		✓			Very faint trace.	
966		I & II 08 25 03 to 08 30 00		✓			Weak	
July 23 967		I & II 10 46 to 10 48		✓			Very faint trace.	
968	iPNE iSNE FNE iPNE iSNE MN ME FNE	I 14 02 22 03 03 M & L 09 00 II 14 02 24 03 04 03 07 03 12 09 00	Blurred	✓ 4.0		7.5 3.0	Intensity II Residents of David, Puerto Armuelles and surrounding country again terrified. But no further damage reported, except a few telephone and telegraph cables fallen down.	
969		I & II 19 51 09 to 19 55 00		✓			Very faint trace.	
July 24 970		I & II 02 47 42 to 02 54 00		✓			Weak	



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Month July 1934Page No. 14

No. and Date	Phase	Time			Period	Amplitude		REMARKS
		G. M. T.				E	N	
		h	m	s		mm	mm	
July 24 971		I & II 06 43 37 to 06 46 00		✓			Very faint trace.	
972		I & II 08 07 56 to 08 11 00		✓			Very weak.	
973		I & II 12 26 56 to 12 31 00		✓			Very weak.	
974		II 14 44 to 14 47		✓			Very faint. Wood-Anderson time-marker not working.	
July 25 975		II 08 41 to 08 47		✓			Very faint trace. Wood-Anderson time-marker not working.	
July 26 976		I & II 03 45 40 to 03 53 00		✓			Frightened people in David and Puerto Armuelles. 3 shocks superposed.	
977		09 03 25 to 09 08 00		✓			Frightened people in David and Puerto Armuelles.	
July 27 978		I & II 13 12 38 to 13 16 00		✓			Very faint trace. Wood-Anderson's stopped at 13:13:12; changing sheets.	
July 28 979		I & II 08 14 55 to 08 18 00		✓			Very faint.	
July 30 980		I & II 10 14 31 to 10 18 00		✓			Very faint trace.	



G. E. MATTHEW,
Acting Chief of Surveys.

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INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED		MASS
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Wood-Anderson	I	Photographic	Magnetic	60 mm. per min.		
Bosch-Omori	II	Smoked Sheet	Air	15 mm. per min.		

INSTRUMENTS—DETERMINED CONSTANTS

INSTRUMENTS	COMPONENT	T.	V	h	DETERMINED
					July 18, 1934
Wood-Anderson	N-S	0.8	1370	critical	"
Wood-Anderson	E-W	0.8	1370	"	"
Bosch-Omori	N-S	20.0	35	"	"
Bosch-Omori	E-W	22.0	35	"	"

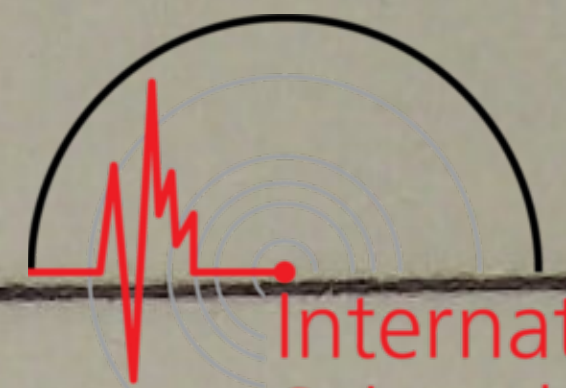
Month August 1934Page No. 15

No. and Date	Phase	Time G. M. T.			Period	Amplitude		REMARKS
		h	m	s		E	N	
						mm	mm	
Wood-Anderson seismographs were not operating from 8:00 a.m. July 31 to 8:00 a.m. August 9, through lack of record sheets.								
II 981 Aug. 1		Between 16:00 & 16:30	✓					Time marker failed. Very faint trace, lasting about 2 min.
II 982 Aug. 2		Between 01:30 & 02:00	✓					Time marker failed. Very faint trace, lasting about 2 min.
II 983 Aug. 2		23:50 to 23:53	✓					Faint trace.
II 984 Aug. 3		06:11 to 06:14	✓					Very faint.
II 985 Aug. 3	IFE ISE ME FE	19:30:35 31:17 31:49 41:00	✓			60		N-S time uncertain.
II 986 Aug. 5		21:15:31 to 21:25:00	✓					Faint
II 987 Aug. 6		10:20 to 10:24	✓					Faint
Bosch-Omori seismographs discontinued, Aug. 8, 1934, but are to be kept in serviceable condition for emergency use. Wood-Anderson seismograph to be used from now on.								
I 988 Aug. 8		21:23:54 to 21:28:00	✓					Very faint.
I 989 Aug. 9		Faint seismic activity about 04:17 to 04:19.						
I 990 Aug. 9		Seismic activity about 06:31 to 06:33						
I 991 Aug. 9		Seismic activity about 08:56 to 08:59						

SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month August 1934Page No. 16

No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS
		h	m	s		E mm	N mm	
I 992 Aug. 9		Seismic activity about 14:26 to 14:29.						
I 993 Aug. 9		Seismic activity about 23:47 to 23:49.						
I 994 Aug. 10	ePNE eSNE FNE	09:02:29 09:02:59 09:07:00						Weak. Dist. approx. 150 to 200 miles.
I 995 Aug. 10	ePNE eSNE FNE	09:08:50 09:18 13:00						Weak. Dis. approx. 150 to 200 miles.
I 996 Aug. 10	iPNE iSNE FNE	14:27:08 27:17 30:00						Intensity IV. This shock started Wenner accelerometer. After beginning of "S" waves movement of light beam was too rapid to be recorded.
		Distance approx. 50 miles						
I 997 Aug. 10	iPNE eSNE FNE	16:21:46 22:17 26:00						Weak.
I 998 Aug. 10	iPNE iSNE FNE	16:27:14 16:27:43 16:31:00						Weak.
I 999 Aug. 10		21:22:16 to 21:25:00						Very faint.
I 1000 Aug. 10		23:25:08 to 23:27:00						Very faint trace.
I 1001 Aug. 10		Seismic activity about 23:46 to 26:48						
I 1002 Aug. 11		11:57 to 12:00						Very faint.
I 1003 Aug. 11	iPNE iSNE MN ME FNE	16:56:52 57:29 57:35 57:32 17:02:00				6.8	8.0	
I 1004 Aug. 12		Seismic activity about 04:40 to 04:42.						
I 1005 Aug. 12		Seismic activity about 09:23 to 09:31.						

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SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month August 1954Page No. 17

No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS
		h	m	s		E mm	N mm	
I 1006 Aug. 12	1PNE 1SNE MN ME FNE	16:55:18 55:58 56:14 56:13 17:02:00			✓		121 12.6	
I 1007 Aug. 12					✓			Seismic activity about 22:31 to 22:33
I 1008 Aug. 13					✓			Seismic activity about 24:09 to 24:13
I 1009 Aug. 13					✓			Seismic activity about 19:52:26 to 19:55:00
I 1010 Aug. 13					✓			Seismic activity about 23:01:50 to 23:05:00
I 1011 Aug. 14					✓			Seismic activity about 09:27:41 to 09:30:00
I 1012 Aug. 14					✓			Seismic activity about 22:35:13 to 22:38:00
I 1013 Aug. 14					✓			Seismic activity about 22:45:08 to 22:47:00
I 1014 Aug. 14		23:31:44 to 23:35:00			✓			Weak.
I 1015 Aug. 15					✓			Seismic activity about 03:44:51 to 03:48:00
I 1016 Aug. 16		14:41:49 to 14:55:00			✓			Epicenter probably 500 miles from station?
I 1017 Aug. 17		17:08:37 to 17:22:00			✓			Very weak.
I 1018 Aug. 18					✓			Seismic activity about 04:30:00 to 04:33:00
I 1019 Aug. 18		19:14:54 to 19:20:00			✓			Weak
I 1020 Aug. 18					✓			Seismic activity about 23:02:56 to 23:05:00
I 1021 Aug. 20					✓			Seismic activity about 01:11:44 to 01:14:00



SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month August 1934

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No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS
		h	m	s		E mm	N mm	
I 1022 Aug. 21		24:17:32						Weak
		to						
		24:22:00						
I 1023 Aug. 21		Seismic activity about 24:24:00 to 24:27:00						
I 1024 Aug. 21		Seismic activity about 05:09:57 to 09:14:00						
I 1025 Aug. 21		Seismic activity about 17:19:40 to 17:23:00						
I 1026 Aug. 22		Seismic activity about 11:04:24 to 11:08:00						
I 1027 Aug. 22		Seismic activity about 22:59:27 to 23:03:00						
I 1028 Aug. 23		Seismic activity about 06:09:48 to 06:12:00						
I 1029 Aug. 23	ePNE iSNE MN ME FNE	21:30:49 31:23 31:36 31:33 34:00			✓	3.6	2.8	Faint
I 1030 Aug. 24		Seismic activity about 08:53:44 to 08:57:00						
I 1031 Aug. 25		Seismic activity about 05:09:30 to 05:13:00						
I 1032 Aug. 27		Seismic activity about 08:14:42 to 08:17:00						
I 1033 Aug. 28		Seismic activity about 14:18:22 to 14:21:00						
I 1034 Aug. 28		Seismic activity about 15:02:20 to 15:05:00						
I 1035 Aug. 29	ePNE iSNE MN ME FNE	02:20:45 21:30 21:36 21:41 25:00			✓	6.0	5.0	Distance 200 to 250 miles.
I 1036 Aug. 30		19:39:47 to 19:45:00			✓			Weak



SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month August 1934

Page No.

No. and Date	Phase	Time G. M. T. h m s	Period s	Amplitude		REMARKS
				E mm	N mm	
I 1037 Aug. 31						Seismic activity about 18:44:14 to 18:47:00 R. Z. KIRKPATRICK, Chief of Surveys.



THE PANAMA CANAL
DEPARTMENT OF OPERATION AND MAINTENANCE
SECTION OF SURVEYS

SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Lat. 8° 57' 39" N.

Long. 79° 33' 29" W.

h=36 meters.

Lithologic foundation: Basalt.

Time Correction: Within 0.5 sec.

INSTRUMENTS—FIXED CONSTANTS

INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED	MASS
Wood-Anderson	I	Photographic	Magnetic	60 mm. per min.	1.3 gr.
Bosch-Omori	II	Smoked Sheet	Air	15 mm. per min.	100. kg.

INSTRUMENTS—DETERMINED CONSTANTS

INSTRUMENTS	COMPONENT	T.	V	h	DETERMINED
Wood-Anderson	N-S	0.8	1370	critical	July 18, 1934
Wood-Anderson	E-W	0.8	1370	"	
Bosch-Omori) Not operating.				
Bosch-Omori					

Month September 1934Page No. 20

No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS
		h	m	s		E mm	N mm	
1038 Sept. 2		Seismic activity about 08:19:21 to 08:23:00						✓
1039 Sept. 3	ePNE eSNE MN ME FNE	12:13:35 14:16 14:23 14:24 18:00					2.1 3.0	Weak ✓
1040 Sept. 2		Seismic activity about 14:47:55 to 14:51:00						✓
1041 Sept. 6		Seismic activity about 06:29:18 to 06:32:00						✓
1042 Sept. 7		Seismic activity about 22:06:52 to 22:09:00						✓
1043 Sept. 8		12:41:20 to 12:47:00						Weak ✓
1044 Sept. 9		Seismic activity about 15:02:08 to 15:09:00						✓
1045 Sept. 9		Seismic activity about 16:45:51 to 16:48:00						✓
1046 Sept. 11		18:57:57 to 19:01:00						Very weak. ✓
1047 Sept. 13		14:41:35 to 14:45:00						Weak ✓
1048 Sept. 13	ePNE ISNE MN ME FNE	15:49:54 50:22 50:32 50:34 54:00					7.8 5.6	Distance approx. 200 miles. ✓
1049 Sept. 15		Seismic activity from 05:38:26 to 05:41:00						✓
1050 Sept. 17		Seismic activity from 22:07:49 to 22:11:00						✓
1051 Sept. 19		Seismic activity from 21:40:44 to 21:44:00						✓
1052 Sept. 20		Seismic activity from 03:15:40 to 03:19:00						✓
1053 Sept. 20		Seismic activity from 10:48:18 to 10:51:00						✓

SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month September 1934

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No. and Date	Phase	Time G. M. T. h m s	Period s	Amplitude		REMARKS
				E mm	N mm	
1054 Sept. 23		Seismic activity from 04:18:48 to 04:22:00				✓
1055 Sept. 24		10:20:11 to 10:24:00				Very weak ✓
No record from 21:00 Sept. 24th to 14:00 Sept. 25th - Battery failed.						
1056 Sept. 28		10:46:57 to 10:50:00				Very weak. Caused some apprehension in David, Republic of Panama.
1057 Sept. 29		13:55:23 to 13:59:00				Weak ✓
1058 Sept. 30		09:47:40 to 09:51:00				Weak ✓



R. Z. KIRKPATRICK,
Chief of Surveys.

THE PANAMA CANAL
DEPARTMENT OF OPERATION AND MAINTENANCE
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SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Lat. 8° 57' 39" N.

Long. 79° 33' 29" W.

h=36 meters.

Lithologic foundation: Basalt.

Time Correction: Within 0.5 sec.

INSTRUMENTS—FIXED CONSTANTS

INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED	MASS
Wood-Anderson	I	Photographic	Magnetic	60 mm. per min.	13 gr.
Bosch-Omori	II	Smoked Sheet	Air	15 mm. per min.	100 kg.

INSTRUMENTS—DETERMINED CONSTANTS

INSTRUMENTS	COMPONENT	T.	V	h	DETERMINED
Wood-Anderson	N-S	0-8	1370	Critical	July 18, 1934.
Wood-Anderson	E-W	0-8	1370	Critical	July 18, 1934.
Bosch-Omori) Not operating.				
Bosch-Omori					

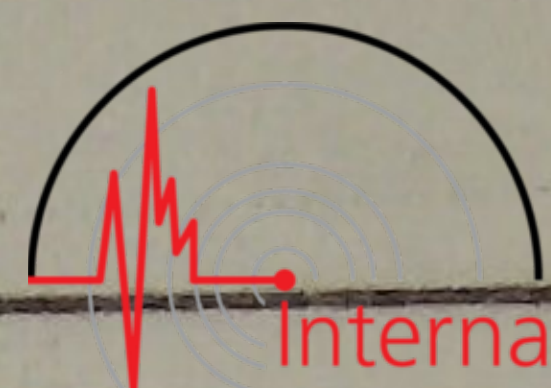
Month October, 1934.Page No. 22.

No. and Date	Phase	Time G. M. T. h m s	Period s	Amplitude		REMARKS
				E mm	N mm	
1059 Oct. 1			Seismic activity about 04:16			
1060 Oct. 3		19:55:18 to 19:58:00	✓			Very weak. Epicenter probably 8°2 N., 82°5 W. Dist. approx. 220 miles.
1061 Oct. 6	1PNE 1SNE MN ME FNE	05:25:31 05:26:28 05:26:37 Blurred - Light dim. 05:31:00	✓		9.5	Distance about 320 miles
1062 Oct. 7			Seismic activity about 12:23			
1063 Oct. 7		15:16:26 to 15:20:00	✓			Weak.
1064 Oct. 8.			Seismic activity about 04:38			
1065 Oct. 9			Seismic activity about 14:27			
1066 Oct. 10		15:58 to 16:30	✓			Very faint trace of long period waves appear intermittently.
1067 Oct. 10	1PE 1SE ME FE	18:59:25 19:00:07 19:00:21 19:04:00	✓		3.5	N-S. Light weak. Epicenter probably 8°2 N., 82°5 W. Dist. approx. 220 miles.
1068 Oct. 11.			Seismic activity about 12:10			
1069 Oct. 11	1PNE 1SNE FNE	17:50:06 17:50:45 17:53:00				Weak Distance approx. 220 miles.

SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month October, 1934Page No. 23

No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS
		h	m	s		E mm	N mm	
1070 Oct. 11		Seismic activity about 24:52						
1071 Oct. 13.		Seismic activity about 19:56						
1072 Oct. 19.		Seismic activity about 23:51.						
1073 Oct. 20.		Seismic activity about 16:36						
1074 Oct. 22		00 24:29 to 25:03 00:33						Record indistinct. Recording lamp set too low.
1075 Oct. 22.		Seismic activity about 06:06						
1076 Oct. 29		21:07 to 21:13						Very faint trace of irregular waves.
1077 Oct. 29		23:28 to 23:36						Very faint trace.
1078 Oct. 31		Seismic activity about 10:04.						

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Chief of Surveys.

THE PANAMA CANAL
DEPARTMENT OF OPERATION AND MAINTENANCE
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SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Lat. 8° 57' 39" N.

Long. 79° 33' 29" W.

h=36 meters.

Lithologic foundation: Basalt.

Time Correction: Within 0.5 sec.

INSTRUMENTS—FIXED CONSTANTS

INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED	MASS
Wood-Anderson	I	Photographic	Magnetic	60 mm. per min.	1.3 gr. 100 kg.
Bosch-Omori	II	Smoked Sheet	Air	15 mm. per min.	

INSTRUMENTS—DETERMINED CONSTANTS

INSTRUMENTS	COMPONENT	T.	V	h	DETERMINED
Wood-Anderson	E-W	0.8	1370	critical	July 18, 1934
Wood-Anderson	N-S	0.8	1370	critical	July 18, 1934
Bosch-Omori	-----NOT OPERATING				
Bosch-Omori	-----NOT OPERATING				

Month NOVEMBER 1934.

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No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS
		h	m	s		E mm	N mm	
1079 Nov. 2	iPEN iSEN ME MN FEN	15	10	12 42 51 52 00	✓	5.3	5.5	Distance approximately 180 miles.
1080 Nov. 5	Seismic activity about 02:06							
1081 Nov. 5		04	54		✓			Weak
			to					
		04	57					
1082 Nov. 5	ePEN iSEN FNE	23	53	42 26 00	✓			Weak
1083 Nov. 7	Seismic activity about 05:55							
1084 Nov. 8	Seismic activity about 12:56							
1085 Nov. 9	iPE iSE eLE ME CE FE	16	12	05 23 29 32 31 00	✓	69.5		Generally felt throughout the Canal Zone and the Republic of Panama. Approximate distance about 130 miles. Intensity IV.
1086 Nov. 9	ePE iSE iLE FE	17	17	34 57 02 50	✓	2.0		Approximate distance about 130 miles.
1087 Nov. 10	Seismic activity about 23:49							
1088 Nov. 10	iPNE iSNE iSNE MN FE	23	23	37 01 38 46 ⁰⁷ 00	✓	19.0	22.0	Distance about 130 miles.
1089 Nov. 11	ePNE iSNE iLNE MNE FNE	2	41	38 22 29 30 00	✓	2.0	2.2	Distance about 260 miles.
1090 Nov. 11	iPN iPE iSN iSE MN ME FNE	3	56	40 41 25 22 31 29 00	✓	2.6	3.0	Distance about 260 miles.

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SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

NOVEMBER 1934

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Month.....

Page No.....

No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS
		h	m	s		E mm	N mm	
1091 Nov. 11	Seismic	activity about			4:20			
1092 Nov. 11	Seismic	activity about			5:40			
1093 Nov. 11	1PNE 1SN 1SE 1LN 1LE MN ME CN CE FNE	7	16	38	✓	50	10.0	Distance about 260 miles.
		7	17	27				
		7	17	26				
		7	17	31				
		7	17	29				
		7	17	39				
		7	17	37				
		7	18	09				
		7	18	11				
		7	22	00				
1094 Nov. 11	Seismic	activity 15:52 - 15:55						
1095 Nov. 11	Seismic	activity 21:00 - 22:00						
1096 Nov. 11	Seismic	activity 18:00						Very faint - irregular.
1097 Nov. 11	Seismic	activity about 19:00						Very faint - irregular.
1098 Nov. 12		4:03			✓			Weak
		to		4:06				
1099 Nov. 16	Seismic	activity about			15:30			
1100 Nov. 18	Seismic	activity about			3:35			
1101 Nov. 20	Seismic	activity about			2:00			
1102 Nov. 22	1PN 1SN 1LN MN FN	16	38	18	✓		2.2	Distance about 150 miles.
		16	38	44				
		16	38	46				
		16	38	53				
		16	41	00				
1103 Nov. 24		1:17			✓			Weak
		to		1:20				
1104 Nov. 25	Seismic	activity about			3:30			
1105 Nov. 25		9	47	40	✓			
		to		9 50 00				
1106 Nov. 25		19:45			✓			Very faint trace - irregular.
		to		19:48				
1107 Nov. 26		3	45	30	✓			Faint trace.
		to		3 47 00				
1108 Nov. 27		6:34			✓			Very faint trace of irregular waves.
		to		6:38				



SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

NOVEMBER 1934

Month.....

Page No.....

No. and Date	Phase	Time G. M. T.			Period	Amplitude		REMARKS
		h	m	s		E mm	N mm	
1109 Nov. 27	Seismic	activity about			16:18			
1110 Nov. 28	Seismic	activity about			3:42			
1111 Nov. 29	Seismic	disturbance about			9:01			
1112 Nov. 30	eNE eSNE eLNE FNE	2	11	12	✓			Trace of long period waves - distant disturbance. Approximate distance of epicenter about 2100 miles.
		2	16	00				
		2	24	00				
		2	48	00				
1113 Nov. 30	Seismic	activity at about			15:06			



R. Z. Kirkpatrick
R. Z. KIRKPATRICK
 Chief of Surveys.

November 1934
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THE PANAMA CANAL
DEPARTMENT OF OPERATION AND MAINTENANCE
SECTION OF SURVEYS

SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Lat. 8° 57' 39" N.

Long. 79° 33' 29" W.

h = 36 meters.

Lithologic foundation: Basalt.

Time Correction: Within 0.5 sec.

INSTRUMENTS—FIXED CONSTANTS

INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED		MASS
				60 mm. per min.	15 mm. per min.	1.3 gr. 100 kg.
Wood-Anderson	I	Photographic	Magnetic	60 mm. per min.		
Bosch-Omori	II	Smoked Sheet	Air	15 mm. per min.		

INSTRUMENTS—DETERMINED CONSTANTS

INSTRUMENTS	COMPONENT	T.	V	h	DETERMINED
					July 18, 1934
Wood-Anderson	E-W	0.8	1370	Critical	July 18, 1934
Wood-Anderson	N-S	0.8	1370	Critical	July 18, 1934
Bosch-Omori	} - - - - -	- - Not Operating - - - - -			
Bosch-Omori					

Month December, 1934.Page No. 25

No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS
		h	m	s		E	N	
						mm	mm	
1114	1E	23:56:53			0.5	2.0		N-S not operating
Nov. 30 to Dec. 1	1E	23:57:18			0.7	1.0		
	eE	23:57:47			1.0	2.0		
	FE	00:04:00						
Dec. 1	E-W	Lamp burned out at 04:36 -			No further record until 13:43.			Dec. 1
1115		01:38						Paint trace of long period waves.
Dec. 3		to 01:53						
1116	1PE	02:41:24			2.0	2.1		N-S not operating Destructive in Honduras. U.S. C.G.S. - Epicenter 15° N. Lat., 89° W. Long. Dist. about 750 miles.
Dec. 3	eSE	02:43:39						
	eE	02:44:09						
	ME	02:44:27						
	FE	03:07:00						
1117		Seismic activity about 09:46						
Dec. 4								
1118		17:31						Very faint trace of long period waves.
Dec. 4		to 17:45						
1119	ePNE	17:46:25						Very weak. Distance approx. 120 miles.
Dec. 7	1SNE	17:46:49						
	FNE	17:49:00						
1120		04:17:18						Weak.
Dec. 11		to 04:23:00						
1121		10:35:36						Weak.
Dec. 22		to 10:39:00						

SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month December 1934.

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No. and Date	Phase	Time G. M. T.			Period s	Amplitude		REMARKS	
		h	m	s		E mm	N mm		
1122 Dec. 23	eN	14	31	26	✓	3.7 3.7	2.6		
	eE	14	31	28					
	eN	14	32	57					
	eE	14	32	58					
	ME	14	33	57					
	ME	14	34	73					
	FNE	14	50	00					
1123 Dec. 23		9	58					Very faint.	
		to							
		10	13						
1124 Dec. 24		14	38					Very faint.	
		to							
		14	48						
1125 Dec. 27	Seismic activity about 13:13.								
1126 Dec. 29	ePNE	04	39	19	✓			Very weak	
	eSNE	04	40	13					Dis. approx. 300 miles
	FNE	04	46	00					
No record from 20:41 Dec. 29 to 14:18 Dec. 30, 1934, N-S and E-W light burned out.									
1127 Dec. 31		18	53		✓			Well defined record of 20.0	
		to							sec. period waves. Max. Amp.
		19	45						2.0 mm.



R. Z. KIRKPATRICK,
Chief of Surveys.