

**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 1.0 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 <sub>0</sub>	V	h	DETERMINED
Wood-Anderson	N	0.80	2740	8 to 1	August 24, 1939
Wood-Anderson	S	0.80	2740	12 to 1	August 24, 1939
Bosch-Omori )	Not	Operating.			
Bosch-Omori )					

Month JANUARY 1940

Page No. 1

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
# 1 Jan. 1		9	43				
			to				
		9	49				
# 2 Jan. 2		4	39				
			to				
		4	44				
# 3 Jan. 7		1	25				
			to				
		1	38				
# 4 Jan. 11	e P N E e P E i S N i S E C N C E F N E	8	40	28			Distance about 240 miles.
		8	40	32			
		8	41	14			
		8	41	11			
		8	41	39			
		8	41	37			
		8	44	00			
# 5 Jan. 12		12	07				
			to				
		12	10				
# 6 Jan. 16	e P N E e S N E L N E M N M E C N C E F N E	00	35	29		4.0 4.0 Distance about 75 miles.	
		00	35	52			
		00	35	58			
		00	36	07			
		00	36	01			
		00	36	24			
		00	36	17			
		00	39				



## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month JANUARY-1940Page No. 2

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#7 Jan. 16	e P N	10	32	24			Distance about 75 miles.
	e P E	10	32	23			
	e S N	10	32	53			
	e S E	10	32	50			
	L N E	10	33	04			
	M N	10	33	06		9.5	
	M E	10	33	06		8.0	
	C N E	10	33	22			
F N E	10	36					
#8 Jan. 17		1	34				
			to				
#9 Jan. 17		10	23				
			to				
#10 Jan. 19		10	26				
#10 Jan. 19	e P N E	6	15	51			Distance about 95 miles.
	e S N E	6	16	22			
	L N E	6	16	23			
	M N	6	16	26		5.0	
	M E	6	16	26		4.8	
	C N E	6	16	33			
	F N E	6	19				
#11 Jan. 23		15	35				
			to				
#11 Jan. 23		15	41				
#12 Jan. 24	e P N E	1	30	38			Distance about 95 miles.
	e S N	1	30	55			
	e S E	1	30	56			
	L N E	1	31	07			
	M N	1	31	10		5.0	
	M E	1	31	09		2.8	
	C N	1	31	30			
	C E	1	31	26			
	F N E	1	33				
#13 Jan. 24	e P N E	5	37	42			Distance about 95 miles.
	e S N E	5	37	58			
	L N	5	38	10			
	L E	5	38	09			
	M N	5	38	13		9.0	
	M E	5	38	11		10.0	
	C N E	5	38	46			
	F N E	5	42				



SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month JANUARY 1940

Page No. 3

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
# 14 Jan. 25		4	55	41			
			to				
		4	59				
# 15 Jan. 26	● P N E ● S N E L N L E M N M E C N F N E	1	35	58		6.0 3.5	Distance about 55 miles.
		1	36	08			
		1	36	16			
		1	36	15			
		1	36	17			
		1	36	17			
		1	36	31			
		1	38				
# 16 Jan. 27		10	17				
			to				
		10	23				
# 17 Jan. 28		7	32				
			to				
		7	39				
# 18 Jan. 28	1 P N E 1 S N E L N E M N M E C N E F N E	15	00	23		12.5 11.5	Distance about 130 miles.
		15	00	40			
		15	00	45			
		15	00	49			
		15	00	50			
		15	01	08			
		15	04				
# 19 Jan. 29	e P N E e S N E L N E M N M E C N E F N E	19	28	54		20.0 14.0	Distance about 260 miles.
		19	29	40			
		19	29	46			
		19	29	49			
		19	29	49			
		19	30	18			
		19	34				
# 20 Jan. 30		11	33				
			to				
		11	36				
# 21 Jan. 30		12	01				
			to				
		12	11				
# 22 Jan. 30		15	24				
			to				
		15	27				



SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month JANUARY 1940

Page No. 4

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
# 23 Jan. 30		24	50 to 57				
# 24 Jan. 31		1	14 to 17				

G. E. MATTHEW,  
Acting Chief of Surveys.



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Bosch-Omori )	Not	Operating.			
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Month February, 1940

Page No. 5

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#25 Feb. 11		12	17				
			to				
		12	21				
#26 Feb. 11		<del>24</del> <sup>0</sup>	08	38			
			to				
		<del>24</del> <sup>0</sup>	21				
# 27 Feb. 12	P N E	6	12	38			Distance about 215 miles.
	S N E	6	12	57			
	L N E	6	13	08			
	M N E	6	13	11			
	C N E	6	13	37			
	F N E	6	15				
#28 Feb. 12		9	14				
			to				
		9	18				
#29 Feb. 16	P N E	2	59	19			Distance about 60 miles.
	S N	2	59	30			
	S E	2	59	31			
	L N	2	59	34			
	L E	2	59	33			
	M N E	2	59	36			
	C N E	2	59	47			
	F N E	3	02				
# 30 Feb. 16	P N E	8	35	42			Disturbance about 130 miles.
	S N E	8	36	05			
	L N E	8	36	09			
	M N E	8	36	11			
	C N E	8	36	17			
	F N E	8	38				
#31 Feb. 18		1	18				
			to				
		1	23				



SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month February, 1940.

Page No. 6.

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#32 Feb. 19		7	21 to 27				
#33 Feb. 28	<ul style="list-style-type: none"> <li>• P N E</li> <li>• S N E</li> <li>F N E</li> </ul>	10	56	20 44 58			Distance about 125 miles.

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Wood-Anderson	N	0.80	2740	8 to 1	August 24, 1939
Wood-Anderson	S	0.80	2740	12 to 1	August 24, 1939
Bosch-Omori		Not Operating			
Bosch-Omori					

Month MARCH 1940

Page No. 7

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE  mm	REMARKS	
		h	m	s				
#34 Mar. 5	S - P	21	+		{N-S E-W	7 10	Time marking mechanism failed.  Distance about 135 miles.	
	L - P			24				
	M - P			41				
	C - P		1	9				
	F - P		4	30				
#35 Mar. 6	1 P N E	20	:	20	:	21	22	Distance about 150 miles.
	• S N	20	:	20	:	47		
	L N	20	:	21	:	10		
	M N	20	:	21	:	27		
	C N	20	:	21	:	54		
	F N E	20	:	27				
#36 Mar. 9	• P N E	15	:	48	:	27		Distance about 275 miles.
	• S N	15	:	49	:	16		
	• S E	15	:	49	:	15		
	F N E	15	:	51				
#37 Mar. 15	• P N E	01	:	35	:	53		Distance about 130 miles.
	• S N E	01	:	36	:	16		
	F N E	01	:	38				
#38 Mar. 16		09	:	14				Barely discernible.
				to				
#39 Mar. 17	• P N E	5	:	19	:	26		
	M N	5	:	20	:	53		
	F N E	5	:	24				
#40 March 25		01	:	06				
				to				
		01	:	08				



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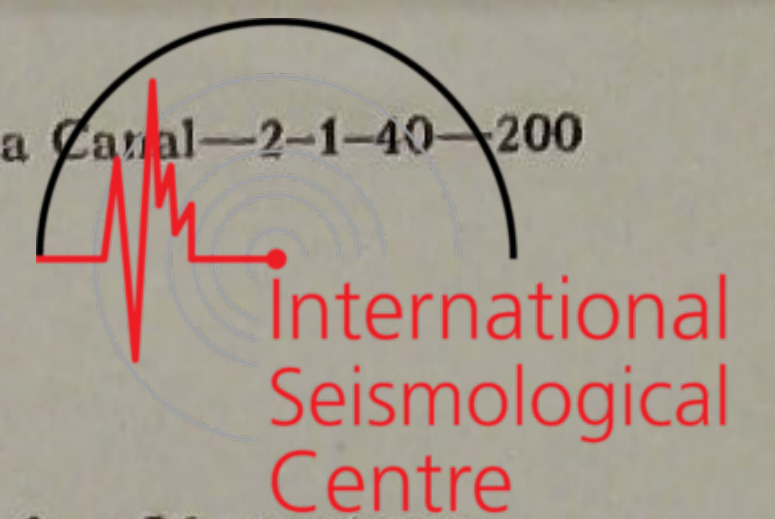
Month MARCH 1940Page No. 8

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#41 Mar. 25		04	: 04				
			to				
		04	: 08				
#42 Mar. 28		16	: 08				
			to				
		16	: 12				
#43 Mar. 28		17	: 51				
			to				
		17	: 54				
#44 Mar. 29		14	: 27				
			to				
		14	: 30				
#45 Mar. 29		15	: 13				
			to				
		15	: 16				
#46 Mar. 31		10	: 15				
			to				
		10	: 18				

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Bosch-Omori )		Not Operating			
Bosch-Omori )					

Month April, 1940Page No. 9

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE	REMARKS
		h	m	s			
#47 Apr. 4	ePNE	22:25:11			16.0	Distance about 70 miles	
	eSNE	22:25:24					
	LN	22:25:30					
	LE	22:25:31					
	ME	22:25:41					
	FNE	22:30					
#48 Apr. 4	ePNE	22:52:40			2.5 2.5	Distance about 60 miles	
	eSNE	22:52:51					
	LN	22:53:01					
	LE	22:53:02					
	MN	22:53:05					
	ME	22:53:07					
#49 Apr. 5	ePNE	11:20:51			6.5 6.0	Distance about 35 miles	
	eSNE	11:20:57					
	LN	11:21:04					
	LE	11:21:03					
	MN	11:21:09					
	ME	11:21:11					
#50 Apr. 5	ePN	11:29:34			3.0 2.0	Distance about 95 miles	
	ePE	11:29:35					
	eSN	11:29:51					
	LN	11:30:04					
	LE	11:30:05					
	MN	11:30:10					
	ME	11:30:11					
FNE	11:32						
#51 Apr. 7		9:51:42					
		to 10:00					
#52 Apr. 7		23:01					
		to 23:03					



## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

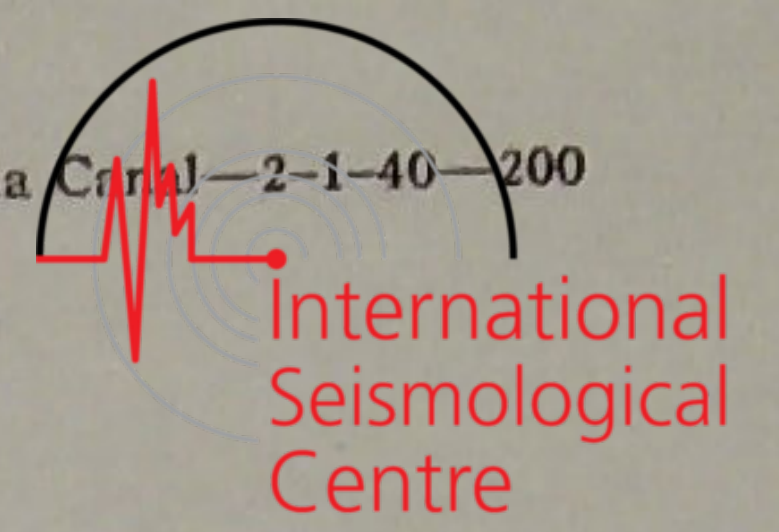
Month April, 1940Page No. 10

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#53 Apr. 8		1:17:09 to 1:19					
#54 Apr. 8		2:01 to 2:03					
#55 Apr. 10		12:50 to 12:53					
#56 Apr. 12		6:14 to 6:17					
#57 Apr. 15		21:03 to 21:06					
#58 Apr. 19		16:05 to 16:08					
#59 Apr. 23		10:56:34 to 10:57:10					
#60 Apr. 27		10:43 to 11:33				Faint distant waves	
#61 Apr. 28	ePN ePE eSN eSE LN LE MN ME CN CE FNE	1:50:53 1:50:54 1:51:24 1:51:23 1:51:44 1:51:45 1:52:00 1:51:52 1:52:09 1:52:13 1:57			12 15	Distance about 170 miles	
#62 Apr. 30		17:06 to 17:08					

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Wood-Anderson	E-W	0.80	2740	12to 1	Aug. 24, 1939
Bosch-Omori)					
Bosch-Omori)		No Operating			

Month May 1940

Page No. 11

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE  mm	REMARKS
		h	m	s			
# 63 May 4		16: 48					
		to 16: 55					
#64 May 5	PNE SNE FNE	2: 07: 26 2: 10: 37 2: 27					Distance about 700 miles
#65 May 6	ePN ePE 1SNE LNE MN ME CNE FNE	9: 00: 18 9: 00: 19 9: 00: 31 9: 00: 34 9: 00: 35 9: 00: 36 9: 00: 55 9: 02			10.5 7.0		Distance about 40 miles.
#66 May 6	1PNE eSNE LN LE MNE CNE FNE	9: 05: 13 9: 05: 23 9: 05: 29 9: 05: 28 9: 05: 31 9: 05: 47 9: 07			{N-6.0 E-5.5		Distance about 30 miles.
#67 May 7	ePNE eSNE LNE MN ME CN OE FNE	18: 56: 00 18: 56: 12 18: 56: 17 18: 56: 18 18: 56: 20 18: 56: 35 18: 56: 39 18: 57: 30			3.7 2.3		Distance about 35 miles



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Month May 1940

Page No. 12

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#68 May 8		16	: 25				
			to				
		16	: 27				
#69 May 9		5	: 36				
			to				
		5	: 38				
#70 May 14		8	: 15 : 58				
			to				
		8	: 18				
#71 May 17	1PNE 1SNE Maximum phases lost due rapid movement of light beam and incoming after-shocks.	2	: 00 : 26				Distance about 120 miles intensity II Modified Mercalli Scale. Felt locally by many people. Some frightened.
		2	: 00 : 48				
May 16	After-shocks from #71 at:-						
			2 : 05 : 00				
			2 : 06 : 09				
			2 : 08 : 59				
			2 : 15 : 52				
			2 : 24 : 31				
			2 : 26 : 08				
			2 : 50 : 39				
			3 : 03 : 25				
			3 : 06 : 00				
			3 : 07 : 31				
			3 : 09 : 06				
#72 May 17	1PNE 1SNE LN LE MN ME CN CE FNE	3	: 13 : 16				Distance about 120 miles Same source as #71 Not felt locally.
		3	: 13 : 38				
		3	: 13 : 54				
		3	: 13 : 55				
		3	: 14 : 00		25		
		3	: 14 : 04		15		
		3	: 14 : 19				
		3	: 14 : 22				
		3	: 20				



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Month May 1940 -----Page No. 13 -----

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
May 17		After-shocks from #72 at: -					
		3	50	00			
		4	09	06			
		4	17	33			
		4	33	03			
		5	20	33			
		5	44	11			
		5	48	40			
#73 May 17		16	58	51			Probably an after-shock of #72.
			to				
		17	01				
#74 May 18		14	07	06			
			to				
		14	08				
#75 May 18		14	31	12			
			To				
		14	34				
#76 May 18		23	28	21			
			to				
		23	29	30			
#77 May 19	ePE	4	44	15			Distance about 2900 miles.
	eSE	4	50	33			
	LE	4	57	40			
	ME	5	02	35			
	FE	5	48				
#78 May 21	1PE	10	11	51			Distance about 120 miles.
	1SE	10	12	13			
	LE	10	12	20			
	ME	10	12	28	5.0		
	FE	10	15				
#79 May 21		22	47				
			To				
		22	49				



SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month May 1940

Page No. 14

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#80 May 22		1	23	40 to 25			
#81 May 22		12	37	41 to 39			
#82 May 24		Long distance disturbance from about 16:38 to 18:45. Distance about 1500 miles. approximate time given marking clock being repaired. Press news information states this quake was very destructive in Peru, S. A.					
#83 May 24	1PE eSE FE	22	02	27 29 52			Distance about 1500 miles Probably an after-shock of #82.
#84 May 25	ePNE MNE FNE	22	38	20 01 41	{E-W 2.0 {N-S 2.2		
#85 May 27	1PNE 1SNE LNE MN CN CE FNE	18	16	14 30 45 56 27 29 21		23.0	Distance about 90 miles.

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Chief Hydrographer.



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Bosch-Omori )					
Bosch-Omori )			Not Operating		

Month June 1940

Page No. 15

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE	REMARKS
		h	m	s			
#86 June 4		23	09				
		to					
		23	12				
#87 June 5		11	12				Very faint waves from distant disturbance.
		to					
		12	00				
#88 June 6		14	41	31			
		to					
		14	43				
#89 June 6	1PN 1SN LN MN CN FN	18	54	52		3.87	Distance about 60 miles
		18	55	02			
		18	55	05			
		18	55	10			
		18	55	41			
		18	58	00			
#90 June 14		18	01	42			
		to					
		18	05				
#91 June 17		19	25	37			
		to					
		19	33				
#92 June 21		18	05				
		to					
		18	07				
#93 June 22		11	56	20			Very faint waves from distant disturbance
		to					
		12	17				



## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month June 1940Page No. 16

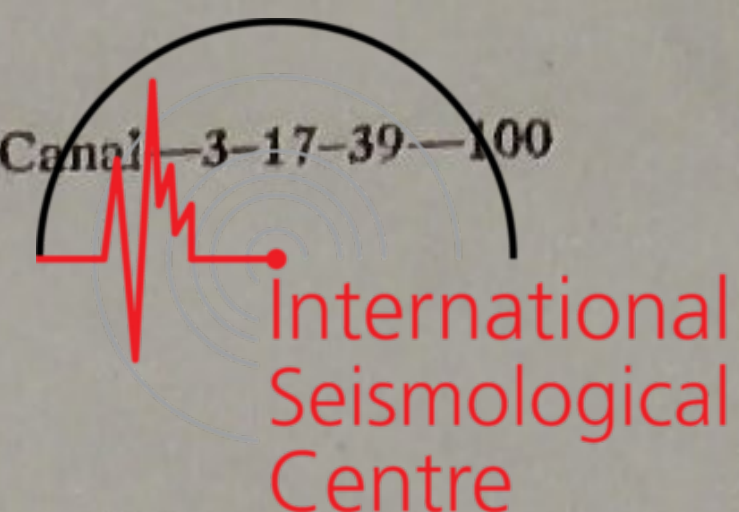
No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#94 June 23	oPNE	19	02	18			
	LN	19	04	18			
	LE	19	04	17			
	MN	19	04	24			
	ME	19	04	21			
	FNE	19	10				
#95 June 29		16	48				
		to	16	51			
#96 June 29		0	36				
		to					
		0	38				

G. E. MATTHEW  
Chief Hydrographer.



**THE PANAMA CANAL**  
DEPARTMENT OF OPERATION AND MAINTENANCE  
SECTION OF SURVEYS

MR 64122—Panama Canal—3-17-39—100



**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 1.0 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	0.80	2740	8 to 1	Aug. 24, 1939
Wood-Anderson	E-W	0.80	2740	12 to 1	Aug. 24, 1939
Bosch-Omori					
Bosch-Omori					

Month July 1940Page No. 17

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#97 July 2	1PN eSN MN CN FN	19	36	09 39 40 22 40		15.0	
#98 July 6		3	44	23 to 4:00:00			
#99 July 10		6	07	to 6:30			Faint waves from distant disturbance
#100 July 11		0	06	to 0:08			
#101 July 13	1PNE eSN LN CN FN	16	48	16 42 00 55 00			Approximate distance 125 miles. Max. amplitude 78+ m.m. Generally felt. Intensity II Modified Mercalli Scale. Maximum phases lost due rapid movement of light beam.
July 13	Minor after-shocks from #101 at:-			17:08:00 18:55:30 18:57:00 21:58:00			



SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month July 1940

Page No. 18

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
July 13	Minor after-shocks from #101 (cont'd)						
		21	32	00			
		22	33	00			
		22	38	00			
		23	48	00			
July 14		00	01	00			
		1	12	00			
		1	56	00			
#102 July 14		6	05	58			Faint phases distant disturbance.
			to				
		6	16	10			
July 14	Minor after-shocks from #101 at:-						
		7	09	00			
		8	45	30			
		9	46	00			
		11	46	00			
		12	12	00			
		12	31	00			
#103 July 14	oPN	18	03	37			
	LN	18	04	17			
	MN	18	04	20		5.0	
	CH	18	04	41			
	FN	18	06	00			
#104 July 14		18	22	00			
			to				
		18	25	00			
#105 July 14		18	26	42			
			to				
		18	30	00			
#106 July 14		18	30				
			to				
		18	32				



SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month July 1940

Page No. 19

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#107 July 14		18	36				
		to					
		18	39				
#108 July 14		19	54				
		to					
		19	57				
#109 July 15		2	24				
		to					
		2	26				
#110 July 15	oPN LN MN CN FN	2	49	14		9.5	
		2	50	00			
		2	54	00			
		2	54	52			
		2	56	00			
#111 July 15		3	22				
		to					
		3	25				
#112 July 15		4	01	30			
		to					
		4	05				
#113 July 15		4	47	17			
		to					
		4	51				
#114 July 15		7	25	30			
		to					
		7	28				
#115 July 15	oPN LN MN CN FN	7	31	47		4.0	
		7	32	32			
		7	32	37			
		7	32	50			
		7	35	00			



## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month July 1940Page No. 20

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#116 July 15	OPNE	8	15	18			
	LNE	8	16	05			
	MN	8	16	14		12.4	
	ME	8	16	13		14.0	
	CNE	8	17	00			
	FNE	8	22	00			
#117 July 15		9	25	46			
			to				
#118 July 15		9	55				
			to				
#119 July 15		9	59	46			
			to				
#120 July 15		10	06				
			to				
#121 July 15		10	14	30			
			to				
#122 July 15		10	19				
			to				
#123 July 15		12	12				
			to				
#124 July 15		12	35	21			
			to				
		12	38				



## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month July 1940Page No. 21

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#125 July 15		13	13				
		to					
		14	00				
#126 July 15	ePN ISN LN MN CN FN	13	24	15		3.5	Approximate distance 170 miles
		13	24	35			
		13	24	58			
		13	25	00			
		13	25	08			
		13	27				
#127 July 15		15	22				
		to					
		15	24				
#128 July 15		16	13				
		to					
		16	16				
#129 July 15		16	54				
		to					
		16	55				
#130 July 15		21	44				
		to					
		21	46				
#131 July 16		12	48				
		to					
		12	55				
#132 July 16	1PN LN MN CN FN	19	12	47		13.8	
		19	13	38			
		19	13	44			
		19	14	11			
		19	20	00			
#133 July 16		19	19	35			
		to					
		19	23				



SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month July 1940

Page No. 22

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#134 July 16		19	24				
			to				
		19	26				
#135 July 16		20	53				
			to				
		20	54				
#136 July 16		20	56	30			
			to				
		20	58				
#137 July 16		21	23				
			to				
		21	24				
#138 July 16		21	39				
			to				
		21	41				
#139 July 16		22	05				
			to				
		22	07				
#140 July 17		0	26	30			
			to				
		0	28				
#141 July 17	1PN eSN LN MN CN FN	6	59	48		52.0	Approximate distance 125 miles
		7	00	03			
		7	00	31			
		7	00	42			
		7	01	09			
		7	10	00			
#142 July 17		14	31				
			to				
		14	33				



## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month July 1940Page No. 23

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#143 July 17		15	51				
			to				
		15	54				
#144 July 17		23	58				
			to				
		24	00				
#145 July 18		6	11	30			
			to				
		6	13				
#146 July 18		12	41	30			
			to				
		12	44				
#147 July 18	ePN eSN MN CN FN	14	11	43		2.5	Approximate distance 155 miles
		14	12	11			
		14	12	33			
		14	12	49			
		14	17	00			
#148 July 18	ePN eSN LN MN CN FN	14	26	22		3.5	Approximate distance 155 miles
		14	26	51			
		14	27	05			
		14	27	06			
		14	27	30			
		14	31	00			
#149 July 18		16	08				
			to				
		16	10				
#150 July 18		16	40				
			to				
		16	41				
#151 July 19		8	17				
			to				
		8	19				



## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month July 1940Page No. 24

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#152 July 19		11	31				
			to				
		11	33				
#153 July 21		4	04	04			
			to				
		4	07				
#154 July 21		6	14	00			
			to				
		6	17				
#155 July 25		11	32				
			to				
		11	34				
#156 July 26		0	46				
			to				
		0	49				
#157 July 27		9	14				
			to				
		9	16				
#158 July 27	epNE esNE LNE FNE	13	35	33			Approximate distance 1500 miles
		13	39	16			
		13	41	05			
		14	10	00			
#159 July 27	1PNE 1SNE LNE MN ME CNE FNE	22	44	21			Approximate distance 55 miles
		22	44	31			
		22	44	37			
		22	44	46		32.0	
		22	44	45		35.0	
		22	45	05			
		22	48	30			



SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month July 1940

Page No. 25

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#160 July 30	1PNE	15	28	24			Approximate distance 130 miles
	oSNE	15	28	48			
	LNE	15	29	22		(N-6.5)	
	MNE	15	29	24		(E-9.0)	
	CN	15	29	49			
	CE	15	29	40			
	FNE	15	36	00			
#161 July 30		16	07				
		to					
		16	13				

G. E. MATTHEW  
Chief Hydrographer.



**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 1.0 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 <sub>0</sub>	v	h	DETERMINED
Wood-Anderson	N-S	0.80	2740	8 to 1	August 24, 1939
Wood-Anderson	E-W	0.80	2740	12 to 1	August 24, 1939
Bosch-Omori )	Not	Operating			
Bosch-Omori					

Month August 1940

Page No. 26

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#162 Aug. 1		15:27:					Distant disturbance. Poorly defined phases.
		to					
		16:40					
#163 Aug. 2		9:38:08					
		to					
		9:41:30					
#164 Aug. 3		16:09:58					
		to					
		16:13					
#165 Aug. 6		22:06					
		to					
		22:09					
#166 Aug. 7		3:02					
		to					
		3:16					
#167 Aug. 9	1PNE eSN eSE LNE MN ME CN CE PNE	5:26:17 5:26:46 5:26:47 5:27:13 5:27:22 5:27:18 5:27:54 5:27:55 5:30:30			8.0 10.0	Approximate distance 170 miles	
#168 Aug. 9		9:47					
		to					
		9:49					



## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month August 1940Page No. 27

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#169 Aug. 15	ePN	2:52:35					Approximate distance 170 miles
	ePE	2:52:37					
	1SNE	2:53:05					
	LNE	2:53:22					
	MN	2:53:37			28.5		
	ME	2:53:38			33.0		
	CN	2:54:04					
	CE	2:54:05					
	FNE	3:00					
#170 Aug. 15	ePN	4:07:58					Principal phases of slight disturbance Superposed on end portion of #170
	ePE	4:07:59					
	MN	4:08:47			3.8		
	ME	4:08:55			3.7		
#171 Aug. 21		9:23 to 9:26					
#172 Aug. 22		3:39 to 4:45					Faint distant disturbance.
#173 Aug. 22	1PNE	11:04:15					Approximate distance 165 miles
	1SN	11:04:45					
	1SE	11:04:44					
	LN	11:05:07					
	LE	11:05:01					
	MN	11:05:15			16.0		
	ME	11:05:11			11.3		
	CN	11:05:42					
	CE	11:05:34					
		FNE	11:15:00				
#174 Aug. 22		14:11 to 14:14					
#175 Aug. 23		8:43:30 to 8:48					



## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month August 1940Page No. 28

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#176 Aug. 23		17:04 to 17:08					
#177 Aug. 24	ePNE 1SN eSE LN LE MN ME CN CE FNE	11:33:29 11:33:57 11:33:57 11:34:14 11:34:10 11:34:20 11:34:12 11:34:44 11:34:43 11:40:00			10.5 10.8	Approximate distance 160 miles	
#178 Aug. 25		00:01 to 00:03					
#179 Aug. 26		1:52 to 1:53					
#180 Aug. 26		2:47:30 to 2:55					
#181 Aug. 26	ePN eSN IN MN FN	5:04:00 5:06:48 5:08:28 5:09:48 5:28:00				Approximate distance 1000 miles	
#182 Aug. 29		23:05 to 23:09					
#183 Aug. 31		17:17 to 17:20					

 G. E. MATTHEW  
Chief Hydrographer.



**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.

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Time Correction: Within 1.0 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	0.80	2740	8 to 1	Aug. 24, 1939
Wood-Anderson	E - W	0.80	2740	12 to 1	Aug. 24, 1939
Bosch-Omori		Not Operating			
Bosch-Omori		Not Operating			

Month September, 1940

Page No. 29

No. and Date	Phase	Time	Period	AMPLI-	REMARKS	
		G. M. T.		TUDE		
		h m s		mm		
#184		14:56				
		to				
Sept. 9		14:59				
#185		23:42				
		to				
Sept. 9		23:45				
#186		4:04:45				
		to				
Sept. 10		4:09				
#187		23:51:34				
		to				
Sept. 10		23:55				
#188	1PN	22:31:44				
	2PE	22:31:46				
Sept. 11	1SN	22:32:25				
	2SE	22:32:35				
	MN	22:32:49		6.6	Approximate distance 130 miles	
	ME	22:32:52		6.7		
	CN	22:33:01				
	CE	22:33:03				
	FNE	22:36				
#189		17:32				
		to				
Sept. 13		17:34				



## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month -----

Page No. 30

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#190 Sept. 14		14:57:50 to 14:59:30					
#191 Sept. 14	PNE SW SE LN LE MN ME CN CE FNE	15:54:11 15:54:17 15:54:20 15:54:20 15:54:23 15:54:22 15:54:24 15:54:41 15:55:30			11.5 7.0	Approximate distance 35 miles	
#192 Sept. 19		9:18:18 to 9:21					
#193 Sept. 21		6:06 to 6:10					
#194 Sept. 22		23:10:34 to 23:22					
#195 Sept. 23		7:21:24 to 7:35					
#196 Sept. 28	PNE LNE MN ME CN CE FNE	10:29:00 10:29:44 10:29:54 10:29:52 10:30:17 10:30:23 10:35			24.0 15.0		
#197 Sept. 29		1:29 to 1:32					

 G. E. MATTHEW  
 Chief Hydrographer.



**THE PANAMA CANAL**  
DEPARTMENT OF OPERATION AND MAINTENANCE  
SECTION OF SURVEYS



**SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE**

Lat. 8° 57' 39" N.

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INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED	MASS
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**INSTRUMENTS—DETERMINED CONSTANTS**

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Wood-Anderson	N - S	0.80	2740	8*01	Aug. 24, 1939
Wood-Anderson	E - W	0.80	2740	12*01	Aug. 24, 1939
Bosch-Omori )	Not operating				
Bosch-Omori )					

Month October 1940

Page No. 31

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#198 Oct. 1		10: 50: 07					Faint phases of distant disturbance
		to 11: 10					
#199 Oct. 3	1 PNE 1 SN 1 SE 1 NE 1 NW 1 ME 1 CN 1 CE 1 FNE	3: 16: 56 3: 17: 46 3: 17: 48 3: 18: 02 3: 18: 22 3: 18: 28 3: 19: 18 3: 19: 03 3: 36:			35.0 28.7		Approximate distance about 300 miles
# 200 Oct. 4	• PNE • SNE • MNE • FNE	8: 01: 12 8: 06: 17 8: 15: 00 8: 54					Approximate distance about 2100 miles Press news indicate this quake was severely felt in the Northern part of Chile, S.A.
# 201 Oct. 5	• PNE • SN • SE • LN • LE • MN • ME • CNE • FNE	14: 39: 55 14: 40: 46 14: 40: 45 14: 41: 06 14: 41: 07 14: 41: 26 14: 41: 30 14: 42: 17 15: 10			44.8 48.6		Approximate distance about 300 miles.
# 202 Oct. 5	• FNE • SNE • MN • ME • CN • CE • FNE	15: 48: 48 15: 49: 40 15: 50: 09 15: 50: 12 15: 51: 10 15: 51: 15 15: 58			6.5 7.5		Distance about 300 miles  Probable aftershock to # 201.



## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month October, 1940Page No. 32

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
# 203 Oct. 5	● PNE	17	18	21			Distance about 300 miles Probably aftershock to # 201
	● SN	17	19	15			
	● SE	17	19	14			
	MM	17	19	59		6.2	
	ME	17	19	41		4.7	
	CNE	17	20	50			
	FNE	17	30				
# 204 Oct. 6		15	44			Very faint phases of distant disturbance	
			to				
		16	15				
# 205 Oct. 7		7	02				
			to				
		7	07				
# 206 Oct. 11		18	13				
			to				
		18	17				
# 207 Oct. 11		18	50			Very faint phases of distant disturbance	
			to				
		19	45				
# 208 Oct. 12	1 PNE	5	25	55			
	● SNE	5	26	05			
	LNE	5	26	09			
	MNE	5	26	12			
	CNE	5	26	20			
	FNE	5	27				
# 209 Oct. 17		5	00				
			to				
		5	02				
# 210 Oct. 17		12	33				
			to				
		12	36				
# 211 Oct. 21		14	45				
			to				
		14	48				
# 212 Oct. 23		2	25				
			to				
		2	33				
# 213 Oct. 24		20	11	58			
			to				
		20	20				
# 214 Oct. 26		4	59				
			to				
		5	02				



SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month October 1940

Page No. 33

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
# 215 Oct. 27	i PNE	5	36	50	( N-45.0 ( ( E-29.5	Distance about 330 miles	
	e SNE	5	37	48			
	LNE	5	38	17			
# 216 Oct. 27	MNE	5	38	37			
	CNE	5	40	41			
	PNE	6	30				
# 217 Oct. 29		2	55				
			to				
		2	59				

G. E. MATTHEW  
Chief Hydrographer.



**THE PANAMA CANAL**  
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SECTION OF SURVEYS



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Wood-Anderson	E - W	0.80	2740	12 to 1	Aug. 24, 1939
Bosch-Omori	) Not Operating				
Bosch-Omori					

Month November 1940Page No. 34

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#218 Nov. 3		21	28				
		21	33				
#219 Nov. 4		2	03				
			to				
		2	06				
#220 Nov. 4	1PNE LNE MNE CNE FNE	4	59	32		21.7	Approximate distance 30 mi. Felt by local residents.
		4	59	40			
		4	59	44			
		5	00	13			
		5	02	00			
#221 Nov. 4	ePNE LN LE MN ME CNE FNE	13	38	27		8.7 6.8	Approximate distance 90 mi.
		13	38	55			
		13	38	56			
		13	39	05			
		13	38	58			
		13	39	34			
		13	41				
#222 Nov. 5		3	39				
			to				
		3	42				
#223 Nov. 7	1PNE MN ME FNE	21	19	31		4.0 4.0	
		21	20	46			
		21	20	45			
		21	23				



## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

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No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#224 Nov. 8	1PNE	16	45	10		2.0 5.2	
	LNE	16	45	51			
	MNE	16	45	55			
	FNE	16	47				
#225 Nov. 10		1	53				
			to	2 : 15			
#226 Nov. 10	oPNE	20	42	40			Approximate distance 310 miles.
	LNE	20	44	17			
	MNE	20	44	21			
	FNE	20	54				
#227 Nov. 12		4	39	05			
			to	?			
#228 Nov. 12		4	45	49			Beginning superimposed on ending of #227.
			to	4 : 54			
#229 Nov. 12		6	56	23			
			to	6 : 59			
#230 Nov. 12	ePN	23	26	41		5.0 5.0	Approximate distance 70 miles.
	ePE	23	26	40			
	LNE	23	27	03			
	MN	23	27	15			
	ME	23	27	12			
	CNE	23	27	39			
	FNE	23	30				
#231 Nov. 15		8	24	08			
			to	8 : 30			



SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month November 1940

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No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#232 Nov. 15	1PNE	16	40	27		4.0 2.5	Approximate distance 130 miles.
	LNE	16	41	10			
	MN	16	41	12			
	ME	16	41	15			
	FNE	16	43	00			
#233 Nov. 16		15	12				
		to					
#234 Nov. 17		5	50				
		to					
#235 Nov. 20		15	10				
		to					
#236 Nov. 23	1PNE	3	50	02		22.0 19.0	Approximate distance about 330 miles
	oSNE	3	51	00			
	LNE	3	51	15			
	MN	3	51	28			
	ME	3	51	32			
	CNE	3	53	11			
	FNE	4	30				
#237 Nov. 23		5	45				
		to					
#238 Nov. 23		8	38				
		to					
#239 Nov 23		12	52				
		to					
#240 Nov. 23		13	09				
		to					
		13	13				



## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

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No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#241 Nov. 24		6	38				
		to					
		6	42				
#242 Nov. 24		7	06				
		to					
		7	08				
#243 Nov. 24		14	09				
		to					
		14	11				
#244 Nov. 24		17	32				
		to					
		17	35				
#245 Nov. 25		9	26				
		to					
		9	28				
#246 Nov. 25		20	14				
		to					
		20	16				
#247 Nov. 26		4	25				
		to					
		4	27				
#248 Nov. 26		9	07				
		to					
		9	10				
#249 Nov. 26		18	45				
		to					
		18	49				
#250 Nov. 27		19	56	37			
		to					
		20	02				



## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

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No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#251 Nov. 29		4	17	30			
			to				
		4	21				
#252 Nov. 29	PNE LN LE MN ME CNE FNE	4	54	34		4.0 3.0	Approximate distance about 220 miles.
		4	55	43			
		4	55	45			
		4	56	05			
		4	56	01			
		4	56	25			
		5	10				
#253 Nov. 29		8	28				
			to				
		8	33				
#254 Nov. 29		13	49				
			to				
		13	53				
#255 Nov. 30		14	11				
			to				
		14	15				
#256 Nov. 30		16	11				
			to				
		16	14				
#257 Nov. 30		16	33				
			to				
		16	37				
# 258 Nov. 30		17	05				
			to				
		17	07				

 G. E. MATTHEW  
Chief Hydrographer.



**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 1.0 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	0.80	2740	8 to 1	Aug. 24, 1939
Wood-Anderson	E - W	0.80	2740	12 to 1	Aug. 24, 1939
Bosch-Omori		Not Operating			
Bosch-Omori		Not Operating			

Month December 1940Page No. 39

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TITUDE mm	REMARKS
		h	m	s			
#259		20	27	16			
		to					
Dec. 1		20	30				
#260	ePNE	21	11	23			
	eSN	21	11	46			
Dec. 1	eSE	21	11	45			Distance about 135 miles
	LNE	21	12	11			
	MN	21	12	14	39.0		
	ME	Blurred					
	CN	21	13	15			
	CE	21	13	25			
	FNE	21	27				
#261	ePN	21	50	14			
	ePE	21	50	15			
Dec. 1	eSN	21	50	37			Distance about 135 miles
	LN	21	50	59			
	LE	21	50	58			
	MN	21	51	12	7.0		
	ME	21	51	14	8.5		
	CN	21	51	37			
	CE	21	51	34			
	FNE	21	55				
#262	1PNE	6	02	09			
	eSN	6	02	32			
	eSE	6	02	34			
Dec. 3	LN	6	02	53			Distance about 135 miles
	LE	6	02	54			
	MN	6	02	56	20.0		
	ME	6	03	07	17.0		
	CN	6	03	52			
	CE	6	03	56			
	FNE	6	09				



## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

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No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#263 Dec. 3		18	09				
		to					
		18	11				
#264 Dec. 4	ePNE	13	55	33			
	LNE	13	56	20			
	FNE	13	59				
#265 Dec. 4	eFN	21	42	40			
	ePE	21	42	41			
	LN	21	43	12			
	LE	21	43	13			
	MN	21	43	20		2.0	
	ME	21	43	24		2.5	
	FNE	21	45				
#266 Dec. 5	ePNE	5	38	35			
	MN	5	39	58			
	ME	5	39	55			
	FNE	5	42				
#267 Dec. 5	ePNE	12	07	47			
	eSNE	12	07	52			
	LNE	12	07	57			
	MN	12	07	58		9.0	
	ME	12	07	59		11.0	
	CN	12	08	16			
	CE	12	08	20			
	FNE	12	10				
#268 Dec. 6	ePNE	23	12	05			
	LNE	23	12	18			
	MN	23	12	19		5.0	
	ME	23	12	21		5.0	
	FNE	23	14				
#269 Dec. 7	ePNE	13	21	00			
	MN	13	22	33		3.0	
	ME	13	22	25		3.0	
	FNE	13	32				
#270 Dec. 7		19	26				
		to					
		19	28				
#271 Dec. 7		21	24				
		to					
		21	26				

Distance about 30 miles



## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

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No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#272 Dec. 12	iPNE eSNE MN CNE FNE	7:11:43 7:11:52 7:12:07 7:12:50 7:16			28.0	Approximate distance 45 miles. Intensity III Modified Mercalli scale. Felt by few local residents.	
#273 Dec. 14		15:21 to 15:24					
#274 Dec. 16		12:21 to 12:23					
#275 Dec. 16	PNE MNE FNE	18:57:12 18:58:05 19:00	(N.S (E.W		2.5 2.0		
#276 Dec. 17		9:56:34 to 9:58					
#277 Dec. 19		12:36:39 to 12:39					
#278 Dec. 20	ePN ePE eSN eSE LN LE MN ME CN CE FNE	15:17:24 15:17:28 15:17:30 15:17:33 15:17:36 15:17:40 15:17:46 15:17:45 15:18:02 15:18:01 15:19			7.5 7.0	Distance about 35 miles.	
#279 Dec. 22		19:05:10 to 19:30					
#280 Dec. 24	ePNE LN LE MNE CNE FNE	1:00:37 1:00:59 1:00:57 1:01:00 1:01:15 1:02:30	( (		8.0 6.5	Distance about 55 miles.	
#281 Dec. 26		6:20:54 to 6:24					