

THE PANAMA CANAL
DEPARTMENT OF OPERATION AND MAINTENANCE
SECTION OF METEOROLOGY AND HYDROGRAPHY



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	0.85	1370	8 to 1	January 22, 1943.
Wood-Anderson	E-W	0.85	1370	10 to 1	January 22, 1943.
Bosch-Omori	Not operating.				
Bosch-Omori					

January, 1944.

Month -----

Page No. 1

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
<p>Maximum trace amplitudes are tabulated for each phase whenever the maximum amplitude for either component exceeds 3.0 millimeters. No entry in the amplitude column indicates an amplitude of less than 3.0 millimeters.</p> <p>Approximate distances are given whenever the P and S phases seem clear and distinct. For earthquakes less than 300 statute miles local tables are used. For earthquakes distant more than 300 statute miles the 1932 Edition of Jeffreys Tables are used. Whenever the beginning of the P and S phases are indistinct, earthquakes are roughly classified as NEARBY and DISTANT depending upon whether the character of the record indicates an epicenter distant less or more respectively than 300 statute miles.</p> <p>All earthquakes felt in any degree by residents of the Canal Zone are rated on the Modified Mercalli Scale, with quakes reliably reported as felt by any one rated at Intensity I.</p>							
#1 Jan. 5	e F	4:13:50					Nearby
#2 Jan. 5	eP eS F	11:01:26 11:03:04 11:22					Similar characteristics as #105 of December 21, 1943. Approximate distance 600 miles.
#3 Jan. 6	e F	16:49:21 17:03					Distant
#4 Jan. 7	1P 1S F	3:10:49 3:11:02 3:14			10.5 N 10.0 E		Approximate distance 65 miles
#5 Jan. 9	1P 1S F	0:57:40 0:58:04 1:02			10.0 - N 9.5 - E 40.0 - N 42.5 - E		Approximate distance 115 miles

SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month January, 1944Page No. 2

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#6 Jan. 10	e i F	1:07:13 1:07:36 1:09					Nearby
#7 Jan. 10	eP eS F	20:14:54 20:19:01 21:15					Approximate distance 1600 miles
#8 Jan. 14	iP iS F	19:45:53 19:46:05 19:48			9.5 - N 11.0 - E		Approximate distance 55 miles
#9 Jan. 15	e i e e F	23:57:19 23:59:11 00:03:17 00:07:10 1:00					Distant
#10 Jan. 16	iP iS F	11:40:24 11:40:34 11:42					Approximate distance 50 miles
#11 Jan. 16	e F	14:30:00 14:39					Nearby
#12 Jan. 21	eP iS F	12:00:12 12:00:41 12:04			5.7 N 7.0 E		Approximate distance 140 miles
#13 Jan. 23	eP iS F	2:22:10 2:22:38 2:24					Approximate distance 135 miles
#14 Jan. 27	e e F	14:32:00 14:32:53 14:36					Nearby

L. T. CHAFEL
Acting Chief Hydrographer

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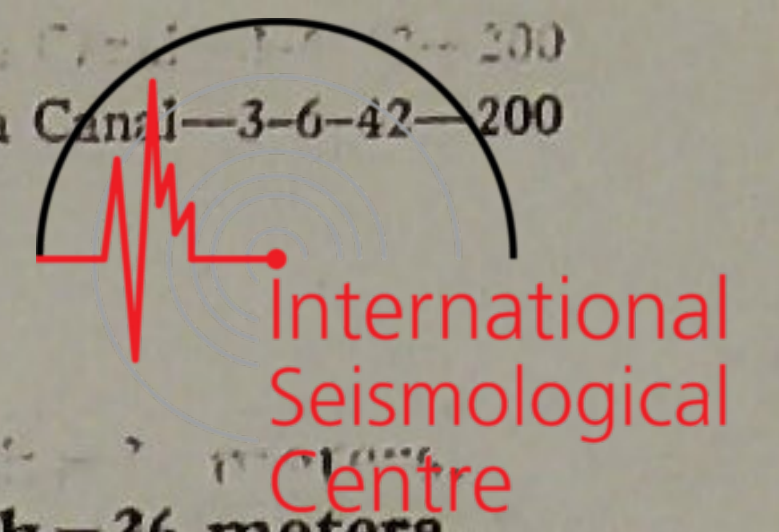
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Wood-Anderson	E - W	0.85	1370	10 to 1	January 22, 1943
Bosch-Omori)	not operating				
Bosch-Omori)					

Month February, 1944Page No. 3

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#15 February 3	e	11	27	33			distant
	e	11	29	10			
	F	11	35				
#16 February 4	1P	2	55	19			Approximate distance 150 miles
	1S	2	55	50		7.0N	
	F	2	59			8.0E	
#17 February 16	e	0	35	49			Nearby
	e	0	36	41			
	F	0	41				
#18 February 16	1P	15	17	41			Approximate distance 145 miles
	1S	15	18	11			
	F	15	21				
#19 February 21	e	20	12	34			Nearby
	1S	20	12	55		10.0N	
	F	20	16			9.0E	
#20 February 22	1P	7	24	44		7.5N	Approximate distance 225 miles
	1S	7	25	31		7.5E	
	F	7	35			16.5N 27.0E	
#21 February 29	1P	3	47	08		4.0E	Approximate distance 1,670 miles
	1S	3	51	24			
	1	3	57	48	3.0	3.0E	
	F	4	06				
#22 February 29	1P	5	44	37		5.0N	Approximate distance 115 miles
	1S	5	45	01		5.0E	
	F	5	48			7.0N 9.0E	

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Chief Hydrographer



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INSTRUMENTS—DETERMINED CONSTANTS

INSTRUMENTS	COMPONENT	T.	V	h	DETERMINED
Wood-Anderson	N-S	Not operating due to shortage of paper, March 1-31, 1944			
Wood-Anderson	E-W	0.85	1370	10 to 1	January 22, 1943
Bosch-Omori	Not operating				
Bosch-Omori	Not operating				

Month March, 1944

Page No. 4

No. and Date	Phase	G. Time G. M. T.			Period	AMPLI- TUDE	REMARKS
		h	m	s			
#23 March 4	e	9:	04:	20		nearby	
	i	9:	04:	57			
	F	9:	11				
#24 March 9	eP	4:	06:	58		approximate distance 290 miles	
	IS	4:	07:	58			
	F	4:	12				
#25 March 9	e	20:	07:	40		nearby	
	e	20:	08:	35			
	F	20:	10				
#26 March 10	e	02:	24:	44		nearby	
	e	02:	25:	11			
	F	02:	27				
#27 March 10	e	16:	34:	20		distant	
	F	16:	39				
#28 March 24	IP	17:	02:	57	3.0E	approximate distance 210 miles	
	IS	17:	03:	41	7.0E		
	i	17:	03:	51	17.0E		
	F	17:	10				
March 30	No record from 13:15 G.M.T. to 20:15 G.M.T., March 30, 1944, adjusting N-S instrument.						
#29 March 31	i	20:	37:	24	2.5	distant <i>amplitude</i> maximum completed of 2.5 millimeters occurred in the first phase at 20:37:35	
	e	20:	39:	08			
	L	20:	39:	44	14		
	F	21:	00:	00			

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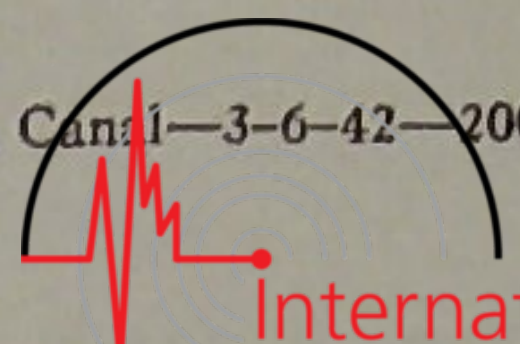
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International
Seismological
Centre

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INSTRUMENTS—DETERMINED CONSTANTS

INSTRUMENTS	COMPONENT	T.	V	h	DETERMINED
Wood-Anderson	N-S	Not operating due to shortage of paper			April 1 - 30
Wood-Anderson	E-W	.85	1370	10-1	January 22, 1943
Bosch-Omori)	Not operating				
Bosch-Omori)					

Month April - 1944Page No. 5

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE	REMARKS
		h	m	s			
#30 April 1	1P 1S F	0:38:40 0:39:05 0:41			4.6E	Approximate distance 120 miles	
April 1	No record from 13:02 GMT to 17:04 GMT April 1, 1944 - Light burned out						
#31 April 7	1P 1S F	13:34:34 13:35:47 13:46				Approximate distance 450 miles	
#32 April 8	1P 1S F	11:47:18 11:47:35 11:50			4.0E	Approximate distance 85 miles	
#33 April 10	1P 1S F	8:04:17 8:04:44 8:08			7.0E	Approximate distance 130 miles	
#34 April 14	1P 1S F	11:43:40 11:44:22 11:48			5.0E	Approximate distance 200 miles	
#35 April 21	• F	15:03:06 15:15				Distant	
#36 April 23	1P 1S F	9:11:05 9:11:42 9:20			11.0E	Approximate distance 180 miles	

SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Month April 1944Page No. 6

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
#37 April 26	oP F	2:13:55					Distant
		2:23					
#38 April 27	o F	14:57:48					Distant
		17:00					
#39 April 28	1P 1S 1 F	5:50:18				5.0E 20.0E	Approximate distance 235 miles
		5:51:07					
		5:52:13					
		6:15					
#40 April 28	o F	7:39:00					Nearby
		7:42:00					
#41 April 29	1P 1S F	18:26:11				5.5E	Approximate distance 250 miles
		18:27:02					
		18:36					

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INSTRUMENTS	COMPONENT	T ₀	V	h	DETERMINED
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Wood-Anderson	E-W	0.85	1370	10 to 1	January 22, 1943
Bosch-Omori)	Not operating				
Bosch-Omori (

Month May 1944Page No. 7

No. and Date	Phase	Time G. M. T.			Period	AMPLITUDE mm	REMARKS
		h	m	s			
* N-S component not operating May 1-5. Operation resumed May 5, 1944.							
Both Wood-Anderson seismographs were readjusted on May 17, 1944 and constants were determined as follows: N-S component, period 1.0 second, magnification 1370, damping ration 20 to 1. E-W component, period 1.0 second, magnification 1370, damping ration 19 to 1.							
# 42 May 4	IP IS F	20:37:30 20:38:27 20:43					Approximate distance 275 miles.
# 43 May 9	E I F	14:31:47 14:33:11 14:43					Distant
May 11		No record		12:35 to 21:34 GMT.			
# 44 May 12	IP IS F	11:43:48 11:44:12 11:46			4.5 N		Approximate distance 115 miles. (No record on E-W component)
May 12		No record		15:12 to 21:09 GMT.			
# 45 May 13	EP ES F	10:18:48 10:19:27 10:22					Nearby. (No record on E-W component)
May 13		No record		13:28 to 20:04 GMT.			



SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

May 1944

Month -----

Page No. 8 -----

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
# 45A May 19-20	May 19	Pronounced microseisms to 03:54 GMT May 20. Approximate amplitude					from 20:36 GMT 0.3 Ma. Period 1.4 Sec.
# 46 May 21	EP ES F	16:18:48 16:19:32 16:23					Approximate distance 210 miles
# 47 May 24	E F	19:48:35 19:52					Nearby
# 48 May 25	E F	13:19 14:40					Distant Faint trace of longperiod waves, long waves with period of about 20 seconds particularly noticeable from 14:09 to 14:20
# 49 May 29	IP ES F	02:44:32 02:45:27 02:55			5.0N 3.5E 3.0N 2.5E		Approximate distance 265 miles

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INSTRUMENTS—DETERMINED CONSTANTS

INSTRUMENTS	COMPONENT	T _c	V	h	DETERMINED
Wood-Anderson	N-S	1.0	1370	20 to 1	May 17, 1944
Wood-Anderson	E-W	1.0	1370	19 to 1	May 17, 1944
Bosch-Omori	} Not operating				
Bosch-Omori					

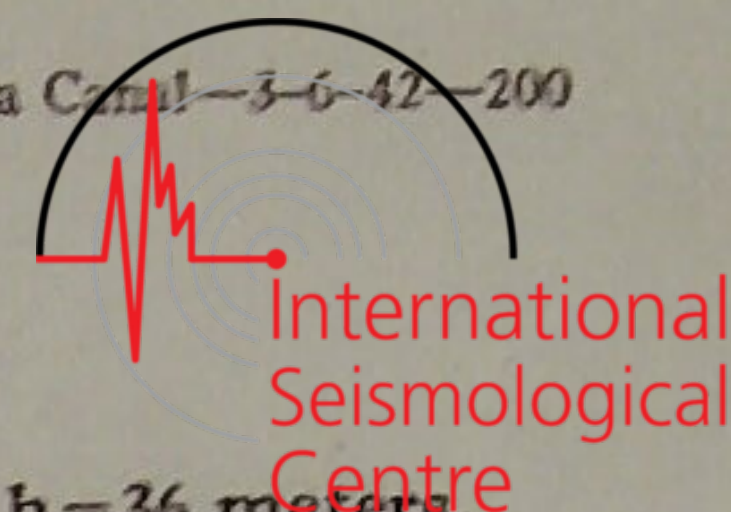
Month June, 1944

Page No. 9

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE	REMARKS
		h	m	s			
#50 June 5	ep	16:08:02				Distant	
	es	16:08:59			4.0E		
	F	16:13					
#51 June 11	ip	19:21:23				Distant	
	e	19:23:07					
	F	19:35					
#52 June 25	ip	02:46:53				Approximate distance 100 miles.	
	is	02:47:13			18.ON		
	F	02:50			12.OE		
#53 June 28	e	8:02:15				Distant	
	eE	8:05:45					
	eN	8:06:55			16.0 2.0		
	F	9:00					

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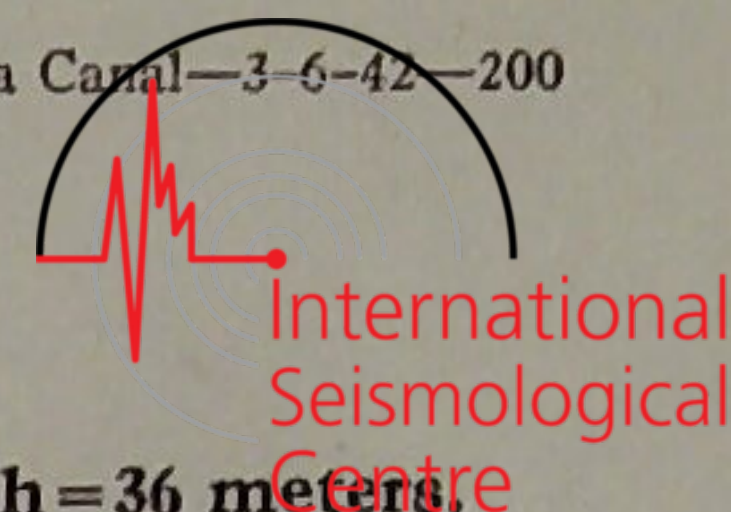
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Bosch-Omori)	Not Operating				
Bosch-Omori)					

Month JULY, 1944Page No. 10

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE	REMARKS
		h	m	s			
# 54 July 2	e P i S F	00:24:47 00:25:07 00:28					Nearby
# 55 July 2	i P i S F	11:16:32 11:17:14 11:20					Approximate distance - 200 miles
# 56 July 10	i P i S F	22:07:08 22:07:17 22:10			19.0N 17.0E		Approximate distance - 45 miles
# 57 July 27	e e F	00:16:30 00:26:25 00:33					Distant
# 58 July 27	e F	02:46:19 02:49					Nearby
# 59 July 31	i P i S F	17:24:32 17:24:53 17:32			21.5N 31.5E		Approximate distance 105 miles

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Wood-Anderson	E-W	1.0	1370	19 to 1	May 17, 1944
Bosch-Omori					
Bosch-Omori		Not operating			

Month August 1944Page No. 11

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#60 Aug. 1	ip	4	:10	:27		2.0N 3.6E	Approximate distance 105 miles
	is	4	:10	:49			
	f	4	:13				
#61 Aug. 2	ip	12	:29	:17		4.0N 4.0E	Approximate distance 245 miles
	is	12	:30	:08			
	f	12	:42				
#62 Aug. 5	ep	13	:09	:00			Distant
	f	13	:20				
#63 Aug. 7	e	3	:30	:59			Distant
	e	3	:35	:46			
	el	3	:40	:54			
	f	4	:10				
#64 Aug. 7	e	19	:29	:40			Nearby
	i	19	:30	:00			
	f	19	:32				
#65 Aug. 9	e	5	:37	:52			Nearby
	f	5	:41				
#66 Aug. 16	e	9	:13	:53			Nearby
	e	9	:14	:18			
	f	9	:16				

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Bosch-Omori)	Not Operating				
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Month September 1944Page No. 13

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE	REMARKS
		h	m	s			
#70 Sept. 3	i P	21	31	23		3.0N 5.0E	Approximate distance 450 miles
	i S	21	32	36			
	F	21	40				
#71 Sept. 10	e	19	56	00			Nearby
	F	19	59	00			
#72 Sept. 11	e	10	05	15			Nearby
	F	10	13				
#73 Sept. 12	e P	14	04	00			Approximate distance 125 miles
	i S	14	04	26			
	F	14	07				
#74 Sept. 17	e	21	06	29			Nearby
	i S	21	06	48			
	F	21	07	30			
#75 Sept. 18	i P	6	12	10		7.0-N 6.5-E	Approximate distance 70 miles
	i S	6	12	24			
	F	6	15				
#76 Sept. 25	e	16	32				Nearby
	F	16	32	20			
#77 Sept. 28	e	19	41	27			Nearby
	F	19	45				

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Wood-Anderson	E - W	1.0	1370	19 to 1	May 17, 1944
Bosch-Omori)		Not operating			
Bosch-Omori)					

Month October, 1944Page No. 14

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#78 Oct 2	o F	17:24:46 17:33					Distant
#79 Oct. 5	1 F	15:24:37 15:26					Nearby Maximum amplitude of 1.5 millimeters occurs within 5 minutes after beginning of record.
#80 Oct. 10	1 F	11:40:29 11:42					Nearby Record similar to #79 above.
#81 Oct. 21	oP 1S F	12:10:17 12:10:56 12:13			3.0E		Nearby
#82 Oct. 23	1P 1S oL F	23:42:08 23:43:33 23:44:12 00:05			4.0N 3.0E 3.0N 3.0E		Approximate distance 500 miles
#83 Oct. 24	1P 1S F	00:29:43 00:31:08 00:41					Approximate distance 500 miles
#84 Oct. 27	o F	00:30:36 00:34					Nearby
#85	1P 1S F	09:28:25 09:28:55 09:31					Approximate distance 145 miles

G. E. MATHEW
Chief Hydrographer

THE PANAMA CANAL
DEPARTMENT OF OPERATION AND MAINTENANCE
SECTION OF METEOROLOGY AND HYDROGRAPHY

SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

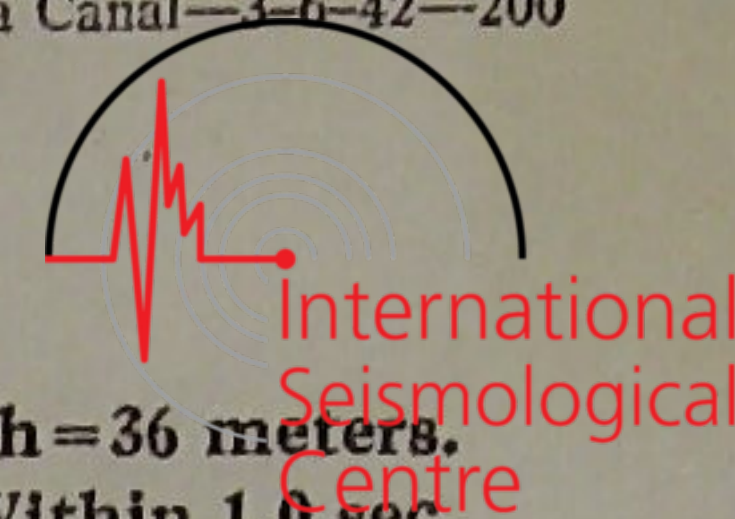
Lat. 8° 57' 39" N.

Long. 79° 33' 29" W.

Lithologic foundation: Basalt.

Time Correction: Within 1.0 sec.

h=36 meters.



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

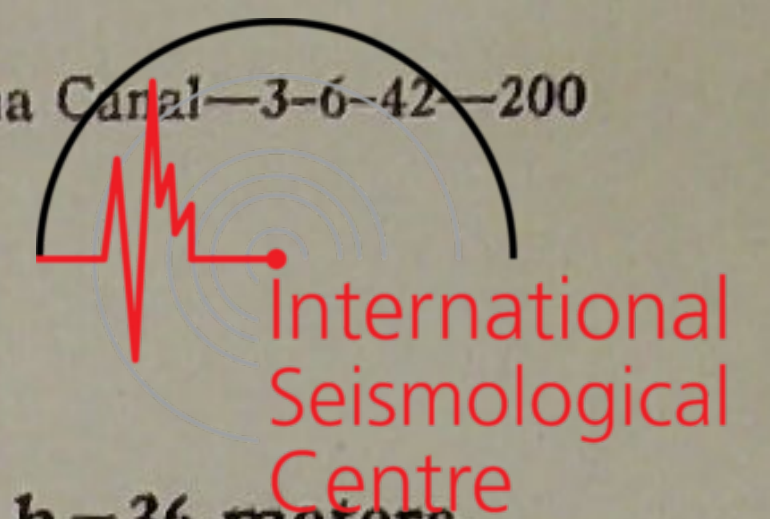
INSTRUMENTS	COMPONENT	T ₀	V	h	DETERMINED
Wood-Anderson	N - S	1.0	1370	20 to 1	May 17, 1944
Wood-Anderson	E - W	1.0	1370	19 to 1	May 17, 1944
Bosch-Omori) Not	In operation.			
Bosch-Omori					

Month November, 1944Page No. 15

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#86 Nov. 15	e F	20:06:50 20:14				Distant.	
#87 Nov. 16	i F	07:08:26 07:11				Nearby.	
#88 Nov. 20	1P 1S F	10:47:24 10:47:51 10:54			5.0 N 4.7 E	Approximate distance 130 miles.	
#89 Nov. 20	e F	11:46:42 11:48				Nearby.	
#90 Nov. 20	e i F	12:05:02 12:05:26 12:08				Nearby.	
#91 Nov. 20	eP 1S F	12:19:15 12:19:33 12:23				Approximate distance 85 miles.	
#92 Nov. 28	eP 1S F	14:23:51 14:24:20 14:32			14.0 N 11.0 E	Approximate distance 140 miles.	
#93 Nov. 28	eP 1S F	16:02:57 16:03:20 16:08			5.0 N 4.0 E	Approximate distance 110 miles.	

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Lat. 8° 57' 39" N.

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h = 36 meters.

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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.
Bosch-Omori	II	Smoked Sheet	Air	15 mm. per min.	100 kg.

INSTRUMENTS—DETERMINED CONSTANTS

INSTRUMENTS	COMPONENT	T _c	V	h	DETERMINED
Wood-Anderson	N-S	1.0	1370	20 to 1	May 17, 1944.
Wood-Anderson	E-W	1.0	1370	19 to 1	" "
Bosch-Omori	Not in operation				
Bosch-Omori					

Month December, 1944.Page No. 16

No. and Date	Phase	Time G. M. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
# 94 Dec. 4	1P	14:58:38				Approximate distance 60 miles. This shock was followed by four aftershocks within 10 minutes, showing similar characteristics.	
	1S	14:58:50					
	F	14:59:20					
# 95 Dec. 4	1P	16:40:15				Approximate distance 60 miles.	
	1S	16:40:27					
	F	16:42					
# 96 Dec. 7	e	04:56				Distant. Record indistinct, consisting mostly of long period waves of small amplitudes. Press reports indicate quake in Japanese Islands.	
	e	05:08					
	eL	05:50					
	F	07:00					
# 97 Dec. 7	eP	23:02:30				Nearby	
	1S	23:03:06					
	F	23:05					
# 98 Dec. 9	1P	14:13:47				Approximate distance 55 miles.	
	1S	14:13:58					
	F	14:15					
# 99 Dec. 9	1P	20:58:16				Approximate distance 60 miles.	
	1S	20:58:28					
	F	21:00					
# 200 Dec. 11	eP	00:56:46				Approximate distance 60 miles.	
	1S	00:56:58					
	F	00:58					

SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Page No. 17Month December, 1944

No. and Date	Phase	Time G. M. T.			Period s	AMPLI- TUDE mm	REMARKS
		h	m	s			
# 101 Dec. 11	iP	01:01:12				Approximate distance 60 miles. This shock was followed by two aftershocks within three minutes.	
	iS	01:01:24			6.0N 9.0E		
	F	01:03					
# 102 Dec. 11	eP	01:12:10				Nearby	
	iS	01:12:22					
	F	01:14					
# 103 Dec. 11	eP	02:36:13				Nearby	
	iS	02:36:25					
	F	02:38					

L. T. Chapel,
Acting Chief Hydrographer.