

ENGINEERING AND CONSTRUCTION BUREAU  
METEOROLOGICAL AND HYDROGRAPHIC BRANCH

## 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.

International  
Seismological  
Centre

## 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	C	DETERMINED
Wood-Anderson	N-S	1.0	1370	14 to 1	June 30, 1947
Wood-Anderson	E-W	1.0	1370	18 to 1	June 30, 1947
Bosch-Omori					
Bosch-Omori					

Month JANUARY, 1953Page No. 1

No. and Date	Phase	Time G. C. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#1 Jan. 1	eP IS F	10:23:16 23:26 10:24				Approximately 50 miles	
#2 Jan. 5	eP eS F	22:51:11 52:19 23:00				Approximately 325 miles	
#3 Jan. 6	eP eS F	23:24:43 25:48 23:39				Approximately 310 miles	
#4 Jan. 7	eP eS F	12:01:22 01:56 12:15				(Felt at El Volcán, Chiriquí. Stopped pendulum clock) U.S.C.G.S. provisional epicenter 9-1/2° N., 83 W. Approximately 160 miles	
#5 Jan. 16	1P IS F	14:58:23 58:30 15:00				Approximately 35 miles	
#6 Jan. 20	1P eS F	09:43:28 43:36 05:47				Felt - Intensity IV Approximately 40 miles	
#7 Jan. 22	eP IS F	00:45:05 45:13 00:47				(Times are approximate. Time marker not operating) Approximately 40 miles	
#8 Jan. 29	1P IS F	08:31:37 32:21 08:36				Approximately 210 miles	

W. H. Esslinger,  
Chief Hydrographer



THE PANAMA CANAL  
ENGINEERING AND CONSTRUCTION BUREAU  
METEOROLOGICAL AND HYDROGRAPHIC BRANCH

## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

Lat.  $8^{\circ} 57' 39''$  N.Long.  $79^{\circ} 33' 29''$  W.

h = 36 meters.

Lithologic foundation: Basalt.

Time Correction: Within 1.0 sec.

International  
Seismological  
Centre

### 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	C	DETERMINED
Wood-Anderson	N-S	1.0	1370	14 to 1	June 30, 1947
Wood-Anderson	E-W	1.0	1370	18 to 1	June 30, 1947
Bosch-Omori	Not in operation				
Bosch-Omori					

Month FEBRUARY, 1953Page No. 2

No. and Date	Phase	Time G. C. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#9 Feb. 4	1P	17	51	30			Distance approximately 40 miles.
	1S		51	38			
	F	17	53				
#10 Feb. 7	eP	09	15	38			Felt in El Volcan.  Distance approximately 185 miles.
	eS		16	17			
	F	09	19				
#11 Feb. 8	eP	19	00	02			Distance approximately 185 miles.
	eS		00	41			
	F	19	03				
#12 Feb. 16	1P	10	11	28			Ships Captain reports strong quake felt in Lat. $8^{\circ} 03' 30''$ N., Long., $83^{\circ} 35'$ W.  Distance approximately 250 Mi.
	1S		12	20			
	F	10	19				
#13 Feb. 22	1P	09	04	41			Distance approximately 65 miles
	1S		04	54			
	F	09	07				



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## SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

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Lat. 8° 57' 39" N.

Long. 79° 33' 29" W.

h = 35 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	G	DETERMINED
Wood-Anderson	N-S	1.0	1370	14 to 1	June 30, 1947
Wood-Anderson	E-W	1.0	1370	18 to 1	June 30, 1947
Bosch-Omori)	Not in operation				
Bosch-Omori)					

Month MARCH, 1953Page No. 3

No. and Date	Phase	Time G. C. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#14 March 1	eP	21	55	06			Approximate distance 70 miles
	iS		55	21			
	F	21	56				
#15 March 15	eP	22	17	31			Approximate distance 185 miles
	eS	22	18	10			
	F	22	25				
#16 March 17	eP	03	37	16			Approximate distance 120 miles
	eS		37	41			
	F	03	39				
#17 March 19	eP	08	32	02			U.S.C.G.S. preliminary determination of epicenter, 14°N. 61°W. Approximate distance 1300 miles
	eS		35	30			
	F	08	53				
#18 March 19	iP	14	19	43			Felt at Balboa Heights Intensity II Approximate distance 80 miles
	eS		19	59			
	F	14	23				
#19 March 20	eP	19	27	47			Approximate distance 280 miles
	eS		28	45			
	F	19	30				
#20 March 22	iP	10	49	19			Approximate distance 100 miles
	iS		49	40			
	F	10	51				
#21 March 26	eP	12	55	38			Approximate distance 145 miles
	iS	12	56	08			
	F	12	58				
#22 March 26	eP	18	50	13			Approximate distance 140 miles
	iS		50	41			
	F	18	52				
#23 March 27	eP	00	41	59			Approximate distance 135 miles
	iS		42	26			
	F	00	45				
#24 March 27	eP	01	06	13			Approximate distance 135 miles
	iS		06	41			
	F	01	08				
#25 March 27	eP	01	35	21			Approximate distance 125 miles
	iS		35	47			
	F	01	40				







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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 1.0 sec.

International  
Seismological  
Centre

## 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	G	DETERMINED
Wood-Anderson	N-S	1.0	1370	14 to 1	June 30, 1947
Wood-Anderson	E-W	1.0	1370	18 to 1	June 30, 1947
Bosch-Omori	Not in operations				
Bosch-Omori					

Month APRIL, 1953Page No. 5

No. and Date	Phase	Time G. C. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#28 April 1	iP	22:38:24				U.S.C.G.S. preliminary determination of epicenter 7-1/2° N., 78-1/2° W. Approximate distance 135 miles	
	eS	38:52					
	F	22:50					
#29 April 2	iP	12:25:54				Approximate distance 135 miles	
	iS	26:22					
	F	12:29					
#30 April 3	iP	08:20:53				Approximate distance 135 miles	
	eS	21:22					
	F	08:24					
#31 April 14	eP	13:33:13				U.S.C.G.S preliminary determination of epicenter 7-1/2° S., 71-1/2° W. (Western Brazil) Approximate distance 1350 miles	
	eS	36:44					
	F	13:45					
#32 April 30	iP	06:26:31				Approximate distance 180 miles	
	eS	27:20					
	F	06:33					



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Seismological  
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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.	V	€	DETERMINED
Wood-Anderson	N-S	1.0	1370	14 to 1	JUNE 30, 1947
Wood-Anderson	E-W	1.0	1370	18 to 1	JUNE 30, 1947
Bosch-Omori	Not in operation				
Bosch-Omori					

Month MAY, 1953Page No. 6

No. and Date	Phase	Time G. C. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#33 May 3	eP	20	25	56			Distance approximately 260 miles
	eS		26	50			
	F	20	29				
#34 May 6	iP	17	25	10			Central Chile - Several killed and minor property damage in Concepción and vicinity. U.S.C.G.S. preliminary determination of epicenter 36-1/2° S. Lat., 73° W. Long. Distance approximately 2,350 miles
	eS		30	36			
	F	18	01				
#35 May 14	iP	22	18	37			Distance approximately 210 miles
	eS		19	21			
	F	22	23				
#36 May 31	iP	20	03	57			Distance approximately 950 miles
	eS		06	29			
	F	20	39				



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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 <sub>0</sub>	V	Q	DETERMINED
Wood-Anderson	N-S	1.0	1370	14 to 1	JUNE 30, 1947
Wood-Anderson	E-W	1.0	1370	18 to 1	JUNE 30, 1947
Bosch-Omori } Bosch-Omori }	Not in operation				

Month JUNE, 1953Page No. 7

No. and Date	Phase	Time G. C. T.	Period	AMPLI- TUDE	REMARKS
		h m s		mm	
#37 June 15	iP iS F	08:06:15 06:44 08:11			Distance approximately 140 miles
#38 June 15	oP oS F	17:25:32 25:49 17:27			Distance approximately 80 miles
#39 June 29	oP oS F	03:28:39 29:27 03:37			Distance approximately 230 miles

## ERRATA: MAY REPORT

#36 iP 20:03:57 should be 20:01:57  
May 31 oS 06:29 should be 04:29



**THE PANAMA CANAL**  
ENGINEERING AND CONSTRUCTION BUREAU  
METEOROLOGICAL AND HYDROGRAPHIC BRANCH

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

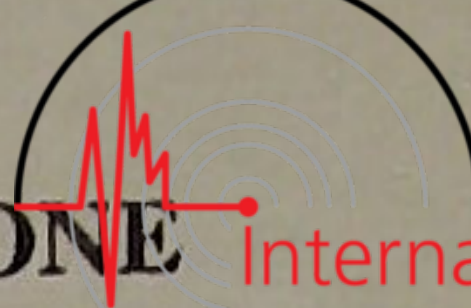
Lat. 8° 57' 39" N.

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h = 36 meters.

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Time Correction: Within 1.0 sec.



International  
Seismological  
Centre

**INSTRUMENTS—FIXED CONSTANTS**

INSTRUMENTS	SYMBOL	REGISTRATION	DAMPING	PAPER SPEED	MASS
Wood-Anderson	I	Photographic	Magnetic	60 mm. per min.	1.3 gr.
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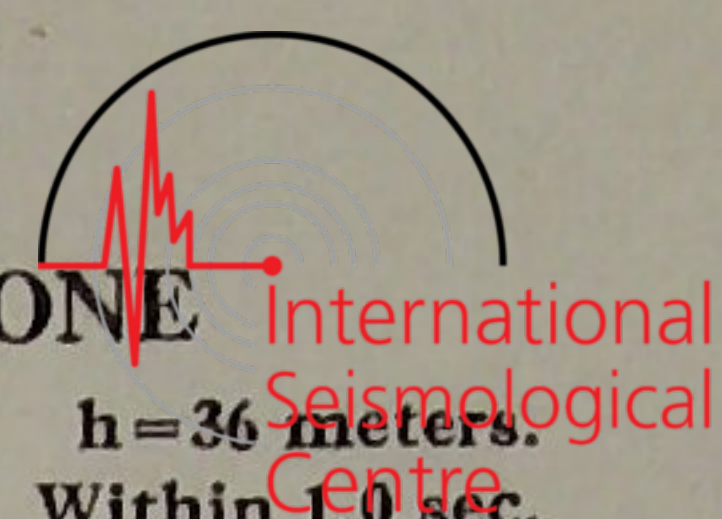
**INSTRUMENTS—DETERMINED CONSTANTS**

INSTRUMENTS	COMPONENT	T.	V	€	DETERMINED
Wood-Anderson	N-S	1.0	1370	14 to 1	June 30, 1947
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Bosch-Omori	Not in operation				
Bosch-Omori					

Month July 1953Page No. 8

No. and Date	Phase	Time G. C. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#40 July 3	eP IS F	08	24	57			Distance approximately 40 miles
#41 July 16	iP IS F	05	56	17			Distance approximately 150 miles





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Wood-Anderson	E-W	1.0	1370	18 to 1	June 30, 1947
Bosch-Omori	Not in operation				
Bosch-Omori	Not in operation				

Month AUGUST 1953

Page No. 9

No. and Date	Phase	Time G. C. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#42 Aug. 4	iP	12	09	49		Felt at Gatun, Intensity II  Distance approximately 45 miles	
	iS		09	58			
	F	12	12				
#43 Aug. 10	iP	12	01	56		Distance approximately 255 miles	
	eS		02	49			
	F	12	05				
#44 Aug. 12	eP	22	34	50		Distance approximately 195 miles	
	iS		35	31			
	F	22	38				
#45 Aug. 21	iP	16	47	21		Distance approximately 300 miles	
	iS		48	24			
	F	16	52				
#46 Aug. 22	eP	16	46	21		Distance approximately 155 miles	
	iS		46	53			
	F	16	49				
#47 Aug. 28	eP	11	50	25		Distance approximately 175 miles	
	eS		51	01			
	F	11	57				

T. C. HENTER,

ACTING CHIEF HYDROGRAPHER.



PANAMA CANAL COMPANY  
ENGINEERING AND CONSTRUCTION BUREAU  
METEOROLOGICAL AND HYDROGRAPHIC BRANCH

SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

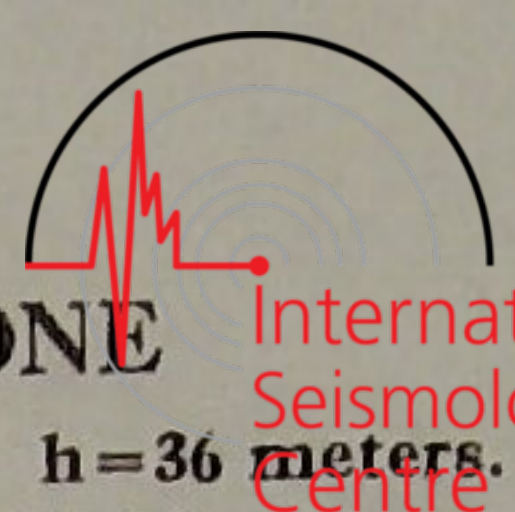
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Bosch-Omori	Not in operation				
Bosch-Omori					

Month September, 1953Page No. 10

No. and Date	Phase	Time G. C. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#48 Sept. 2	iP	03	03	44			Felt-Intensity II Distance approximately 45 miles
	iS		03	53			
	F	03	06				
#49 Sept. 26	iP	22	09	18			Distance approximately 95 miles
	iS		09	38			
	F	22	11				
#50 Sept. 27	eP	06	10	22			
	S	not determined					
	F	06	16				
#51 Sept. 29	iP	03	23	16			Distance approximately 205 miles
	iS		23	59			
	F	03	27				

03-27

W. H. ESSLINGER  
Chief Hydrographer



# SEISMOLOGICAL RECORD AT BALBOA HEIGHTS, CANAL ZONE

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International Seismological Centre

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

INSTRUMENTS	COMPONENT	T.	V	C.	DETERMINED
Wood-Anderson	N-S	1.0	1370	14 to 1	June 30, 1947
Wood-Anderson	E-W	1.0	1370	18 to 1	June 30, 1947
Bosch-Omori )	Not in operation				
Bosch-Omori )					

Month OCTOBER, 1953

Page No. 11

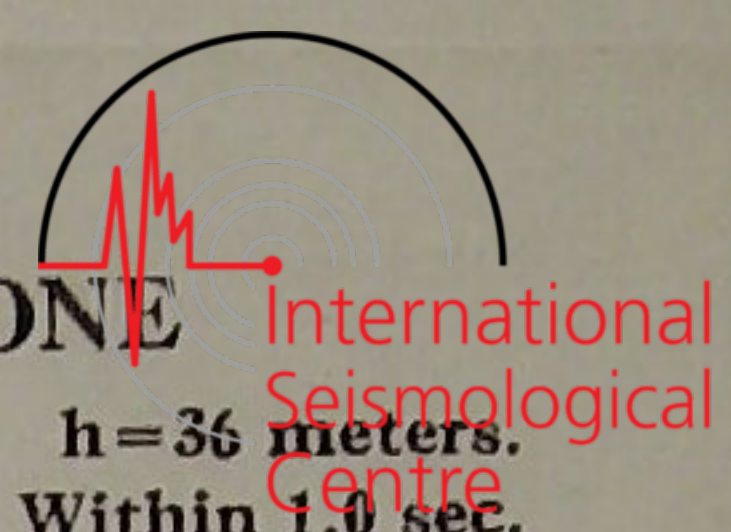
No. and Date	Phase	Time G. C. T.			Period	AMPLITUDE mm	REMARKS
		h	m	s			
#52	eP	00-59-42					
	eS	Not determined					
Oct. 25	F	01-04					
#53	iP	04-28-03					
	iS	28-19					
Oct. 26	F	04-30					Distance approximately 77 miles
#54	iP	16-25-18					
	iS	25-22					
Oct. 26	F	16-26					Distance approximately 20 miles

W. H. ESSLINGER  
Chief Hydrographer



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Bosch-Omori)	Not in operation				
Bosch-Omori)	Not in operation				

Month NOVEMBER, 1953Page No. 12

No. and Date	Phase	Time G. C. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#55 Nov. 5	iP iS F	04:06:10 06:37 04:09				Distance approximately 130 miles	
#56 Nov. 17	iP S F	13:33:05 not determined 14:15				U.S.C.G.S. preliminary determination of epicenter 14° N, 92° W	
#57 Nov. 23	iP iS F	16:05:51 05:55 16:07				Distance approximately 20 miles	
#58 Nov. 30	iP iS F	15:36:36 36:39 15:38				Distance approximately 15 miles	



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Wood-Anderson	E-W	1.0	1370	18 to 1	June 30, 1947
Bosch-Omori )	Not in operation				
Bosch-Omori )					

Month DECEMBER, 1953Page No. 13

No. and Date	Phase	Time G. C. T.			Period	AMPLI- TUDE mm	REMARKS
		h	m	s			
#59 Dec. 3	eP	16:05:17					Approximate distance 20 miles
	eS	05:21					
	F	16:06					
#60 Dec. 3	eP	17:36:04					Approximate distance 95 miles
	eS	36:24					
	F	17:38:09					
#61 Dec. 7	1P	02:12:06					U.S.C.G.S. preliminary determination of epicenter 22° S. Lat. 68-1/2° W. Long. Northern Chile. Heavy casualties & extensive property damage Approximate distance 2250 miles
	eS	17:21					
	F	02:41					
#62 Dec. 7	1P	17:31:06					Approximate distance 110 miles
	1S	31:29					
	F	17:34					
#63 Dec. 12	1P	17:34:31					U.S.C.G.S. preliminary determination of epicenter 3-1/2° S. Lat. 81° W. Long. near coast of Peru. Approximate distance 950 miles
	eS	37:04					
	F	19:32					
#64 Dec. 13	1P	17:23:38					Approximate distance 130 miles
	1S	24:05					
	F	17:28					
#65 Dec. 19	eP	16:39:25					Approximate distance 230 miles
	eS	40:13					
	F	16:44					
#66 Dec. 21	1P	15:45:41					Approximate distance 20 miles
	1S	45:45					
	F	15:47					
#66 & 7 Dec. 23	1P	19:32:52					Approximate distance 105 miles
	1S	33:14					
	F	19:35					